DOCUMENT RESUME

ED 264 821 IR 011 903

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TITLE	Nebraska Videodisc Science Laboratory Simulations. Executive Summary (and) Science Lab Videodiscs: Evaluation Report. A Report from the Annenberg/CPB Project.
INSTITUTION	Nebraska Univ., Lincoln.
SPONS AGENCY	Corporation for Public Broadcasting, Washington, D.C.
PUB DATE	Mar 85
NOTE	333p.
PUB TYPE	Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01/PC14 Plus Postage.
DESCRIPTORS	Academic Achievement; Biology; Chemistry; *Computer Assisted Instruction; *Computer Simulation; Field Tests; Higher Education; *Instructional Material Evaluation; Physics; Questionnaires; *Science Instruction; Student Attitudes; Teaching Methods; Undergraduate Study; *Videodisc Recordings
IDENTIFIERS	*Instructional Effectiveness

ABSTRACT

To explore the potential of computer controlled videodiscs for simulating undergraduate science laboratory instruction, the Annenberg/CPB (Corporation for Public Broadcasting) Project funded the University of Nebraska to create and field test six videodisc laboratory experiments, two each in biology, chemistry, and physics. The six discs were field tested with nearly 700 college students and 45 instructors in seven colleges and universities across the country to yield information on the following topics: the instructional, pedagogical, and production quality of the discs; faculty and student acceptance of this approach; how the simulations compared with traditional science laboratories; and costs of the new technologies compared to traditional approaches. Data were collected using formal and informal methods--surveys, interviews, observations, and anecdotal reports. Results of the field tests indicate that both faculty and students identified effective features of each disc, particularly self-pacing aspects and opportunities for feedback. Discs were less well received by faculty at research universities than at smaller colleges and universities; however, all faculty agreed that videodiscs are appropriate for teaching experiments that otherwise could not be taught, and for teaching students who otherwise would not have access to science laboratory instruction. In addition to the executive summary, this document also includes the complete evaluation report which provides information and data on: details of the evaluation method, student demographics and attitudes, acceptability of videodiscs to instructors and students, comparison of videodisc and laboratory experiments, costs, the future potential of videodisc, recommendations, and references. Appendix A provides a critique of each of the six videodiscs and Appendix B provides detailed questionnaire results. (JB)

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Nebraska Videodisc

Science Laboratory Simulations

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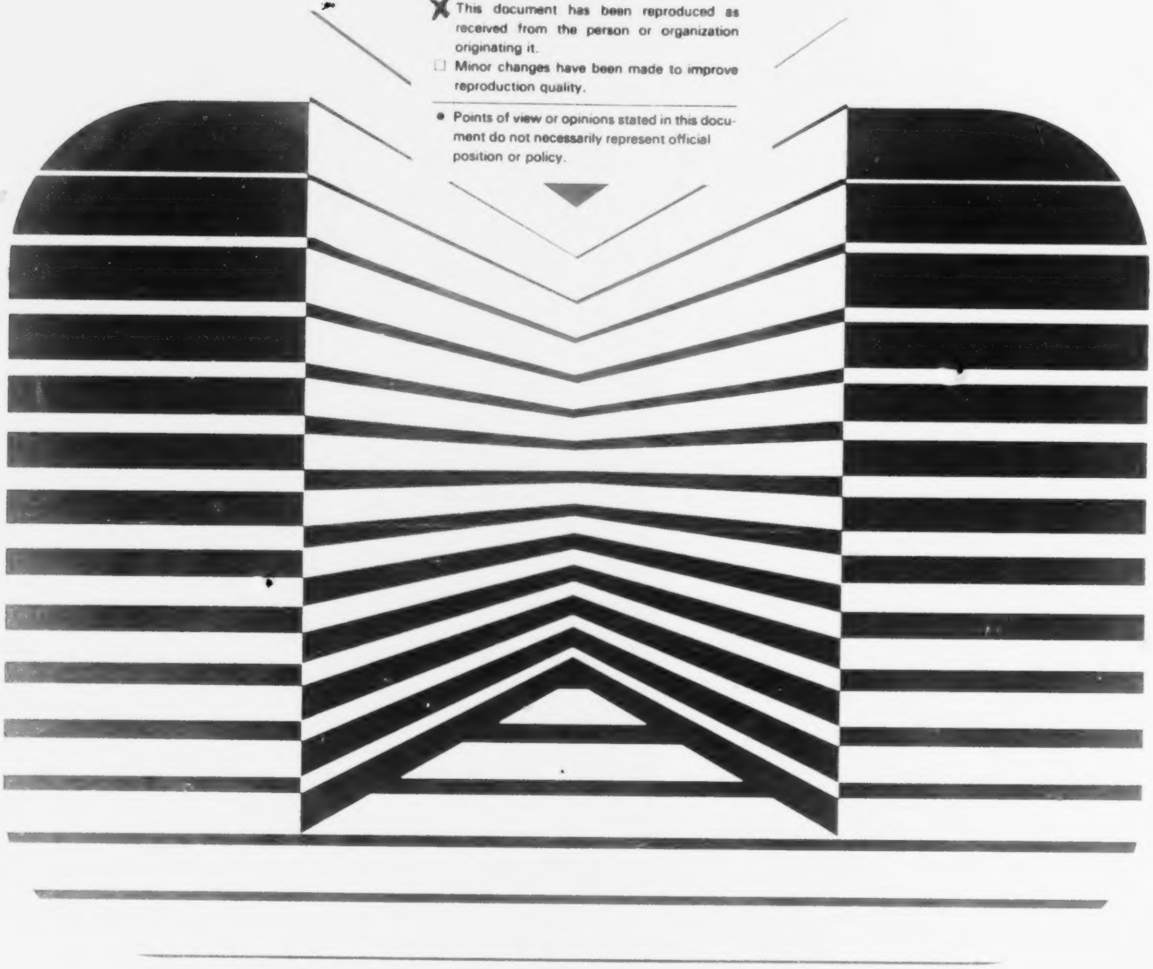

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Executive Summary

Nebraska Videodisc
Science Laboratory Simulations

The Annenberg/CPB Project

March 1985

The contents of this Executive Summary are excerpted from a longer report submitted to the Annenberg/CPB Project by Barbara Gross Davis, Ph.D.

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Background

The purpose of this project was to explore the potential of computer controlled videodiscs for simulating undergraduate science laboratory instruction. The Annenberg/CPB Project funded the University of Nebraska-Lincoln to create and field-test six videodisc laboratory experiments, two each in biology, chemistry and physics.

The University had argued that it is increasingly expensive to offer science laboratory instruction because of the cost of equipment and the lengthy time required to set up and break down complex experiments. Furthermore, they argued, science laboratories are often open only 8 to 10 hours per day and are not, therefore, readily accessible to non-traditional students. Since the Annenberg/CPB Project had been established to increase access to higher education for non-traditional students, the Project was interested in exploring ways to overcome these barriers.

Videodisc simulations of science experiments were seen as one way to lower costs (once produced, discs can be copied for about $15 and the costs of hardware systems are expected to drop to the $1000 to $2000 range) and to increase accessibility (disc players can be placed in libraries which are often open 18 to 24 hours per day). Their major question was whether science laboratory experiments could be simulated adequately and be as effective instruction as traditional labs.

The six discs were field tested with nearly 700 college students and 45 instructors in seven colleges and universities across the country. The field tests yielded information on the instructional, pedagogical and production quality of the discs, faculty and student acceptance of this approach, comparisons to traditional science laboratories and costs of the new technologies compared to traditional approaches. This paper summarizes the findings of the field test.

Effects on Student Learning and Attitudes

The design of the evaluation allowed faculty members to use the videodiscs in whatever manner they judged appropriate, rather than imposing constraints on how the institutions should use the discs. This enabled the evaluation to address a disc's performance in actual institutions and curricula.

Of the nearly 700 students from whom data were collected, 506 performed videodisc simulations and 183 students performed traditional "wet" laboratory experiments. Two of the institutions randomly assigned students to videodisc, while four universities asked for student volunteers to conduct the simulations. At one institution the videodisc simulation was a course requirement.

To assess the effects of the videodiscs on student learning, samples of their worksheets were examined and instructors' perceptions as well as students' self-reports were analyzed.

Worksheets showed that students were generally able to understand the concepts and ideas presented on videodiscs. In open-ended comments they reported learning the following: content-related facts, ideas, major theses; scientific processes; how to use videodisc equipment; and scientific reasoning. In addition, students reported that what they had learned was worth the effort they had made.

When looking at test score data, it was found consistently that videodisc students performed as well as or better than their "wet" lab counterparts.

The study found that in a traditional "wet" lab, the performance of the experiment tends to overshadow the other phases of preparation and analysis. The videodisc simulation, however, integrates all three phases of the lab experience (preparation, experimental observation, and analysis) and requires students to be actively engaged in the preparation and the design of the experiment, including the choosing of variables and parameters.

The students indicated that all six videodisc simulations had been very effective for teaching basic principles and "average" in helping them to understand and calculate results. Students seemed generally satisfied with the discs as a useful learning experience, a response similar to those students who conducted traditional laboratory experiments.

The study also found that students who used the videodisc simulations were significantly more confident in following instructions than their traditional lab counterparts. This confidence most likely reflects the consistent precision required by the computer used to control the videodisc. Students also reported being neither bored nor confused during the labs. When asked what they especially liked about the new medium, students and their instructors mentioned the opportunity for self-pacing and user control. They also valued the immediate feedback and consistency of presentation. Students reported that they would like to see more labs on videodisc but were ambivalent as to whether they prefer the videodisc simulations over traditional lab experiences.

Faculty Acceptance of Videodisc Science Labs

Nearly all faculty members recognized the potential of videodiscs to teach science laboratory experiments and acknowledged that well-conceived, high-quality discs could be a very useful teaching tool. Many saw the videodisc as supplementing rather than replacing traditional "wet" labs. Many, however, were also exthusiastic about using videodiscs to provide experiences not possible through other means. For example, high costs, scheduling restraints and space limitations often deny non-science majors the opportunity to take any science laboratory courses. Videodiscs were seen by the faculty as appropriate substitute laboratory experiences for those students.

An interesting finding of this study is that the discs were less well received at research universities than at smaller colleges and universities. It was noted that large research institutions typically have greater resources and more specialized faculty than smaller institutions and might not have as great a need for the experiences provided by the videodisc labs. Consequently, faculty at the research universities maintained that the current versions of the videodiscs might provide an appropriate supplement to their traditional lab classes but should not be used to replace those classes. Users at state and community colleges were more positive about using the videodisc experiments in place of traditional labs.

Quality of Content

Biology

The two biology videodiscs are entitled "Respiration" and "Climate & Life." While using the "Respiration" videodisc, students experimentally determine the effects of varying temperatures upon the respiration rate of three common organisms. Students select the organisms and temperatures they wish to study, observe the organisms at the selected temperatures, record dye movement through a manometer at selected intervals, and chart changes in respiration rate. The "Climate & Life" videodisc explores major geographical areas of the world (biomes) and their corresponding plant and animal life. Students can: view ten biomes, such as tundra, chaparrel and tropical rain forest; study life forms, terrains and climatograms of the biomes; and explore, interactively, factors that determine biome distribution.

The quality of the content for both courses was rated by students and faculty as equivalent to traditional labs. "Respiration" generally was rated higher than "Climate & Life," but both were rated high in terms of accuracy, currency of information, appropriate use of examples, appropriate vocabulary level, completeness, use of sound pedagogical principals, and likelihood of promoting understanding of the concepts.

The following instructional features of these discs were rated high by students:

- readability of text,
- instructions,
- feedback provided to the student,
- visual images used,
- opportunities to review and skip parts of the lesson.

Student worksheets and the instructor manual were rated weak for "Climate & Life."

In spite of the high ratings given to specific characteristics of the biology videodiscs, the faculty generally maintained that the discs were inferior to other instructional approaches such as "wet" lab experiences, standard textbook presentations, and lab manual presentations. Nevertheless, the faculty generally stated that videodiscs were considered appropriate for independent learners who otherwise would not have access to any laboratory experiences. "Climate & Life" was also thought appropriate for college freshman and sophomores and high school seniors especially as a supplements to "wet" lab experiences. Overall, the production value of the biology discs received higher ratings than the instructional value.

Chemistry

The two chemistry videodiscs were generally received very well by students and faculty. They are "Titration" and "Chemical Decision Making." In the "Titration" videodisc the student is taught to determine the concentration of a solution. By first learning the basic concepts and techniques of titration, the student is then able to proceed with a large number of experiments by varying the initial parameters stored in the computer. "Chemical Decision Making," the second chemistry experiment, allows the student to mix electronically several hundred possible chemical combinations and challenges him/her to observe chemical reactions, calculate unknowns, and explore properties of different elements.

Both experiments received high scores for accuracy, currency, appropriate uses of examples, and appropriate reading/vocabulary level. They received average scores for the difficulty of the challenge provided to the student, the amount of new information, and the level of information. "Chemical Decision Making" was rated especially high on sophistication of logic and reasoning, motivating and interesting students, and provoking higher-order thinking.

In rating the instructional features of the labs, both students and faculty gave the discs high scores for:

- opportunities to review and skip parts of the lesson,
- visual images used,
- feedback provided to the student,
- readability of text,
- opportunity for students to work at own pace.

When instructors were asked to compare the videodisc with other instructional methods, they replied that "Chemical Decision Making" exceeded their expectations although it was not considered by most to be a suitable substitute for "wet" lab experiments. "Titration" scores were average in all areas.

Instructors thought that both the disc programs were appropriate for college freshmen and sophomores and high school students. "Chemical Decision Making" was also considered appropriate for independent learners. Overall, production quality and instructional value were rated high or above average for both discs.

Physics

"Studies in Motion" and "Energy Transformation" were the two physics videodiscs evaluated by students and instructors. The "Studies in Motion" videodisc provides instruction in kinematics centered on measuring the motion of divers, gymnasts and ballet dancers. The computer software was developed for students with little mathematics background and is designed to lead them through an exploration of four kinds of motion: free-fall, up-and-down, projectile and rotational. By moving the cursor on the screen, students can take measurements for numerical calculations. In the "Energy Transformation" videodisc, energy transformations that occur while a bicycle is being ridden are shown. Energy losses due to rolling and wind resistances are determined from airport runway and wind tunnel sequences on the videodisc. Energy output is computed from kinetic energy of the bicycle and cyclist, measured on rollers in the laboratory. Using this videodisc, students can compute velocities and accelerations as a function of time in ways difficult to achieve with other instructional media.

Both experiments were highly rated for accuracy, use of examples, currency of information, and promoting understanding of the concepts. They were rated average or slightly below on the difficulty of the challenge provided to the student, the amount of information, and the level of information. The following instructional features were rated high:

- opportunities for students to work at own pace,
- readability of text,
- visual images used,
- instructions,
- explanations,
- student worksheets and review.

Both labs were considered equivalent to or slightly better than other instructional methods.

Instructors viewed both "Studies in Motion" and "Energy Transformation" as appropriate for lower-division college and high school students. About half of the respondents viewed the discs as appropriate for independent learners as well. Production quality was rated high by the faculty.

Comparisons to Traditional Labs

In comparing videodisc simulations to traditional laboratories, the study found that clear distinctions exist between the benefits of an experiment conducted on videodisc and an experiment conducted in a traditional lab setting.

Time. Students using videodisc typically work through an expriment more quickly than a conventional lab where students spend time setting up, waiting between data collection points, cleaning up and correcting errors. Using the videodisc in "Respiration," for example, students need not wait for the temperature changes but can see the results almost instantly. Students who spent 40 minutes with the videodisc "Respiration" lab were able to carry out a complete experiment of one organism at three temperatures. By spending 60 minutes, the number of organisms can be increased to two or three whereas in a traditional lab this same experiment can take up to three times as long to complete.

Content. Videodiscs enable students to examine a wider variety of conditions than is possible in a traditional lab. Students can explore more unknowns, investigate more organisms, study more biomes as well as perform experiments over a wider range of conditions.

Procedures. Students using videodiscs appear less confused about what to do than students in the traditional lab who frequently check with the lab assistant to make sure the experiment is being conducted accurately. The videodisc provides a more structured yet individualized approach than most labs. Interactive preparation is obligatory for videodisc students who must work through preparatory sections before conducting an experiment. This is not necessarily so in traditional labs where preparatory lessons leading up to the lab experience tend to be left optional to the student. In the traditional lab with one lab assistant and 20-30 students, students receive less individual monitoring and tutorial assistance. As a result students cannot always receive the timely clarification or correction always available from the ever-patient computer used to control the videodisc simulations.

Task-Oriented Behavior. Because videodisc provides fewer distractions for students, students appear to be more task-oriented and almost completely focused on conducting the experiment. Students in traditional labs exhibit a wider variation in behavior, and time actually spent on the task can be short. It is apparent that some students in traditional labs focus on the experiment, but others may just be marking time. In many cases, students can become restless toward the end of a three-hour lab period. Videodisc students are allowed to stop the program at key points. Consequently, less restlessness or distracted behavior was observed.

Pedagogical Advantages of Videodisc. Because students have to make choices and respond to the program, they become actively involved in learning. Research literature shows that learning increases when students become active learners and receive feedback on their efforts. In addition, a wide range of students can be served by a single videodisc program because videodisc can match the pace and timing of presentation to a learner's requirements. Students can be routed to appropriate remediation sections of the disc as necessary, and they can repeat and review sequences that they do not understand or that they wish to explore more carefully.

Comparative Costs

Costs for developing and using videodiscs are not well established and depend on a number of factors including ratio of film footage to still frames, the degree to which electronics and computer-generated graphics can be used to create still frames, the number of iterations carried out in the formative stage of development, the extent to which preexisting film footage can be used, the size of the development team working on the disc, the desired quality of the product, the production facilities used, and the type of production (e.g., studio or on location).

Widespread use of videodiscs will depend on lowered costs, which will in turn depend on the vagaries of the videodisc industry. Costs of hardware are declining, however, and many colleges and universities are experimenting with videodisc. Over the last several years, the cost of microcomputers has decreased by 30%, and videodisc players by 20%. Moreover, the availability of interface devices to control a videodisc player by a microcomputer are becoming commonplace. While the initial hardware and software is currently expensive (about $3500 per unit), recurring costs are less for videodisc than for traditional labs.

A formal complex cost analysis was beyond the scope of this evaluation, but to estimate the cost of videodisc instruction, the study compared expenses of teaching respiration by traditional laboratory methods and by videodisc. Among the host of variables that could be incorporated into cost calculations, certain factors were assumed to be constant across the methods: for example, energy use, maintenance, obsolescence, and so on.

The cost comparisons showed three things:

First, if a user must build a new space or renovate an existing space to offer science labs, it is more expensive to provide "wet" lab facilities than to install a videodisc system.

Second, if existing space is used, without modifications, teaching respiration through a traditional lab is initially less costly than purchasing a complete videodisc system. However, the recurring costs of personnel and materials are much greater for a traditional laboratory than for videodiscs. In that case, over-time, the videodisc approach would become cost effective. The amount of time needed to reach a break-even point is not clear at this time.

Finally, if existing space is used without any modifications and if only a videodisc interface need be purchased (at about $500), teaching respiration by videodisc is less expensive from the start than teaching it through a traditional lab.

Conclusions

The major question examined by this study was whether science laboratory experiments could be simulated adequately and be as effective instruction as traditional "wet" labs.

The study found that students using the videodisc simulations consistently performed as well as or better than students in traditional labs. Furthermore, the videodisc group worked through their experiments more quickly and were able to experiment with a wider variety of conditions than the traditional lab students.

Nearly all faculty recognized the potential of videodiscs to teach science laboratory experiments but expressed ambivalence about whether the videodisc simulations were appropriate substitutes for as opposed to supplements to traditional "wet" labs. There was little ambivalence, however, about two applications of the videodisc simulations: faculty agreed that they are appropriate to teach experiments that otherwise could or would not be taught (e.g., because of cost or dangerous conditions), and to teach students who otherwise would not have access to science laboratory instruction (e.g., independent learners).

The Annenberg/CPB Project
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SCIENCE LAB VIDEODISCS

Evaluation Report and
Appendix A: Critique of Each Videodisc

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July, 1984

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SUMMARY

In 1981 the University of Nebraska, Lincoln, received a grant to develop interactive videodiscs for teaching introductory college level physics, chemistry, and biology. In the Annenberg/CPB Project, six videodisc lab experiments were produced: two in each of the three content areas. The videodiscs are designed to enable students to perform science laboratory experiments (such as respiration in biology and titration in chemistry) by using a personal computer that is connected to a videodisc player. Some of the videodisc experiments duplicate existing traditional laboratory procedures (for example, Titration, Respiration, Chemical Decision Making). Others cover material not typically found in a lab setting (for example, Physics of Motion, Climate and Life, and Energy Transformation).

At the request of the videodisc developers, an evaluation was conducted to examine these areas: quality of the videodiscs, effects of the discs on students' learning and attitudes, acceptability of the new technology, comparison of videodisc with traditional laboratory methods and costs, and the potential of videodisc in higher education. Data were collected from more than 600 students and 45 instructors and content experts in seven universities and colleges across the country using formal and informal methods—surveys, interviews, observations, and anecdotal reports.

Quality of the Discs. Both students and faculty identified effective features of each disc, particularly self-pacing aspects and opportunities for feedback. For each disc, they also noted problems that limit usefulness. In biology, Respiration was viewed more favorably than Climate and Life. In chemistry, Chemical Decision Making was rated higher than Titration by instructors. Students rated both chemistry discs about the same. In physics, the discs were rated about equally by students. Motion was viewed more favorably by instructors. Detailed critiques and suggested revisions for the programming were prepared for each videodisc.

Student Outcomes. Evaluation data reveal that students can learn from interactive videodiscs and can identify specific content, information, concepts or ideas they gained from working through the program. Students also report learning aspects of the scientific process and reasoning from these videodiscs. In addition, the videodiscs capture students' attention: they are neither bored or confused as they view the discs.

Acceptability of Videodisc as a Medium. Faculty are willing to consider using high quality, well-developed discs in their teaching and students seem attracted to and will work through a videodisc. Faculty acceptance may depend less on hard data about outcomes than on the disc's compatibility with course curriculum and instructor's philosophy and teaching style.

Comparison of Videodisc and Laboratory Experiments. Clear distinctions exist between the benefits of an experiment conducted on videodisc and one conducted in a traditional laboratory setting. Students using videodisc work through the experiment more quickly, cover a wider range of content, are less distracted than their traditional lab counterparts, evidence less confusion over procedures, and exhibit more task-oriented behavior, greater self-sufficiency and more willingness to take risks. However, they have a more limited experience than students in a traditional lab: they engage in less peer interaction or discussion with the TA; there are fewer opportunities for in-depth explanations or elaborations of key points; they are unable to compare results with other students who may achieve different outcomes. Despite these observed differences, no meaningful differences were noted between lab and videodisc students in self-reported amount of learning or impact of mode of instruction on students' interests and attitudes.

Test score data were gathered and analyzed at one biology field test site. For Respiration, no differences in quiz performance were found between videodisc and lab students. For Climate and Life, videodisc students achieved higher scores than their lab counterparts.

Students and instructors at the research university test sites feel that the current versions of those videodiscs that duplicate traditional lab experiments should not be used to replace the traditional lab but to provide an appropriate supplement. Used before an experiment, the videodiscs can orient students to procedures, introduce a wide range of content, and demonstrate the results to be expected. Used after an experiment, videodiscs can reinforce students' learning, allow students to explore issues in more detail, and enable them to correct any inaccuracies in their lab experiment. Users at state and community colleges seem more positive about the discs that duplicate traditional labs.

Because videodisc is primarily a medium of individual interaction, its widespread use will depend on costs. While the initial hardware and software are currently expensive, recurring costs are less for videodisc than for traditional labs.

Potential of Interactive Videodisc Technology. Stubborn obstacles to the use of videodisc in higher education include: faculty hesitation to accept innovation, costs, lack of standardization in the videodisc industry, vagaries of the videodisc business, and a dearth of suitable programs at appropriate levels. Yet, with improved technology and the development of high-quality discs, the videodisc medium may well have a future in higher education. In particular, videodiscs that simulate laboratory experiments are especially useful in teaching time-consuming procedures, hypothetical conditions, potentially dangerous procedures, and investigations that require expensive materials or equipment. Videodiscs also would seem to be useful in situations where laboratory facilities are impractical—for example, in rural or off site learning situations—or to provide an approximation of lab work for nonscience majors, for whom economic and space limitations preclude traditional lab experiments.

Recommendations. Videodisc developers are encouraged to adopt pedagogical approaches and features known to be effective (mastery levels, immediate feedback, reinforcement, review units); to captialize on the intrinsic strengths of the medium (user control, rapid pacing); and to produce materials that are compatible with current curricula. Discs that duplicate existing laboratories should be marketed at smaller colleges and institutions.

Funding agencies are encouraged to continue to provide support for videodisc development and evaluation so that educators and researchers can determine both the potential of videodisc as a medium of instruction and the quality and value of particular videodisc products.

Evaluators of individual videodisc products are encouraged to emphasize formative evaluation over summative assessment at this stage of the new medium's development; to perform limited field testing that emphasizes on-site observation and interviewing; and to design protocols that distinguish between the characteristics of videodisc as a medium and the quality of a particular videodisc product.

OVERVIEW OF THE VIDEODISC PROJECT

Description of an Interactive Videodisc System

A videodisc looks like a long-playing silver phonograph record without grooves. Actually the grooves are so tightly packed that they are invisible to the naked eye. Videodiscs store information, sound, and images that are then read by tiny lasers in a videodisc player. Videodiscs are claimed to be more durable, store more information, and offer faster access to that information than other storage media, including conventional magnetic videotapes (DeBloois, 1982; Schneider and Bennion, 1981).

Videodisc technology blossomed in the 1970s and was heavily marketed for home use in the early 1980s, mostly by way of television commercials that promised Hollywood movies in your own living room at reasonable cost. Educational applications have been less publicized, but advocates have been equally enthusiastic. New technology now allows students to hook up a videodisc player to a microcomputer. By using the two machines in tandem, students can move images across a full-color video screen, design personalized instructional sequences, determine their own learning preferences, and select information at an appropriate level and pace. Because the user can make choices, engage in a dialogue, and control the pace and sequence of the videodisc's display, rather than passively follow a preprogrammed routine, such a system is called interactive.

The hardware for an interactive videodisc system (or intelligent videodisc) consists of a color monitor, a microcomputer, and an industrial videodisc player. To work the system, a student inserts a videodisc into the player and a programmed floppy diskette into the microcomputer. The sequence and rate of image presentation are controlled by typed instructions on the microcomputer's keyboard.

An interactive videodisc system is characterized by three features:

1) Nonlinear format of content. The information on the videodisc is organized into discrete modules or units that need not be studied in a predetermined order. For example, a videodisc describing various climates of the earth allows students to choose which topics they wish to study (desert, tundra, grasslands, etc.) and in what order.

2) User controlled options. The student can choose to terminate the program, reexamine a specific instructional unit of the program, or skip other units on the disc entirely.

3) User self-evaluation. The videodisc lesson includes frequent quizzes and questions that enable students to gauge their understanding of the material.

Instructional videodiscs have been developed in many areas: in business (General Motors trains its mechanics by videodisc), in medicine (Hon, 1982, describes a videodisc for teaching cardiopulmonary resuscitation), in teaching literacy (HumRRO, 1982, produced a disc on study and test-taking skills), and in military training (Holmgren et al., 1979-80, discuss army training discs). Discs have been designed for college and pre-college curricula. ABC Video Enterprises and the National Education Association have produced a Schooldisc to teach 4th, 5th, and 6th graders. Discs for college students have been developed at the University of Iowa (Art History), University of Utah (introductory physics), and the Center for Aerospace Education (space science).

The Science Lab Videodiscs

In 1981, the University of Nebraska, Lincoln, received a grant from the Annenberg/CPB Project to develop interactive videodiscs for teaching introductory college-level physics, chemistry, and biology. Six videodisc laboratory experiments were produced. The videodiscs are designed so that students may perform scientific experiments by using a personal computer connected to a videodisc player. Some of the videodisc experiments are designed to substitute for the traditional laboratory. In these simulated science labs, students use a microcomputer and video screen the way they use test tubes, lab equipment, or chemicals in a traditional lab. Electronically, they mix chemicals, modify temperatures, and then observe the results. Other videodisc lessons give students the opportunity to conduct experiments and explore subject matter not possible in a traditional lab, for example, investigating the physics of motion by examining divers, gymnasts, and dancers.

The hardware delivery system consists of a Pioneer 7820-3 videodisc player interfaced to a modified TRS-80 Model III computer containing an overlay circuit card (developed by the Nebraska Videodisc Group) that superimposes computer text and graphics onto NTSC video. A high-resolution graphics card supports the overlay.

The computer software is written in UCSD Pascal. A printed instruction guide, containing information for the instructor and worksheets and course materials for students, accompanies the videodiscs.

Biology Videodiscs

Respiration. In this videodisc, students experimentally determine the effects of varying temperatures upon the respiration rate of three common organisms: a pea seedling, a frog, and a mouse. Respiration rate is measured by the movement of dye through a narrow tube called a manometer. The greater the respiration rate, the more rapidly the dye will be displaced down through the tube. Students select the organisms and temperatures they wish to study, observe the organism at the selected temperatures, record dye movement at selected intervals, and chart changes in respiration rate.

Using this videodisc, students are instructed in and quizzed on how to formulate hypotheses, control variables, collect data, organize and graph information, and draw conclusions from experimental findings.

Climate and Life. This videodisc explores major geographical areas of the world (biomes) and their corresponding plant and animal life. Students can view ten major biomes, such as tundra, chaparral, and tropical rain forest, and study the life forms, terrains, and climatograms. (A climatogram is a histogram of temperature and precipitation patterns over a typical year.) Students can move through the disc at their own pace in any order they choose. Quizzes and frequent questioning encourage students to master the basic concepts.

This subject is typically taught from textbooks and lectures. On the videodisc, students can view color motion sequences of the biomes and explore, interactively, factors that determine biome distribution.

Chemistry Videodiscs

Chemical Decision Making. In this videodisc, students investigate chemical unknowns. By electronically mixing chemical combinations, of which several hundred are possible, students can observe chemical reactions, calculate unknowns, and explore properties of different elements. After an initial introductory sequence on the characteristics and properties of different chemicals, students can choose the type of experiment and level of difficulty. Conditions simulate laboratory practice in identifying chemical unknowns. Students gain skills in formulating hypotheses, conducting experimental investigations, and understanding scientific processes.

Titration. A typical lab experiment, that of determining the concentration of a solution, has been transferred to an interactive videodisc. Students begin by learning the basic concepts and techniques of titration and then conduct titration experiments.

The hardware has been modified with a paddle-controlled stopcock in a way that closely simulates the physical process of titration. A potentiometer connected to the computer allows the students to turn a stopcock which on the screen will drain a titrant from a burette into a flask. The end point is signaled by a color change in the liquid undergoing titration. By varying the initial parameters stored in the computer that controls the disc, a student can perform a large number of titration experiments.

Physics Videodiscs

Studies in Motion. This videodisc provides instruction in kinematics centered on measuring the motions of divers, gymnasts, and ballet dancers. The motions vary from simple, straight drops from a three-meter diving board to the complex projectile and twisting motions of gymnastic floor exercises.

The computer software was developed for students with little mathematics and is designed to lead them through an exploration of four kinds of motion: free fall, up-and-down, projectile, and rotational. By moving the cursor on the screen, students can take measurements for numerical calculations.

While these topics might be covered in a traditional laboratory, the treatment is usually qualitative. With this videodisc, students can chart motions and calculate effects.

Energy Transformations Featuring the Bicycle. Energy transformations that occur while a bicycle is being ridden are shown in this videodisc. Energy input is computed from the forces on the pedals measured during rotation. Energy losses to rolling and wind resistances are determined from airport runway and wind tunnel sequences on the videodisc. Energy output is computed from kinetic energy of the bicycle and cyclist, measured on rollers in the laboratory.

This disc is designed for students who have studied calculus and basic energy concepts. The computer program offers students direct access to a large array of visual data. For example, the portion of the videodisc showing the rolling resistance of a bicycle is combined with a computer overlay cursor to enable the student to find the location of the bicycle at each thirtieth of a second. Consequently the student can compute velocities and accelerations as a function of time in ways difficult to achieve with other instructional media.

OVERVIEW OF THE EVALUATION

Originally both formative and summative evaluations of the videodiscs were planned. The formative evaluation, handled internally by the University of Nebraska, was to identify the strengths and weaknesses of the discs and make revisions before they were released to the field test sites. The external evaluation was to examine the product in a natural setting and determine its effectiveness. The two discs in each disciplinary area were to be completed about the same time and field tested during one semester in the appropriate place in the course curriculum. Because of production delays, the discs were completed one at a time over several months and often reached the field test sites out of sequence in the curriculum and in the first versions that had not been rigorously reviewed for errors or problems. As a result of the field testings of the first disc (Climate and Life), the evaluation was reoriented to focus substantially on formative issues:

1) The evaluation was refocused to gather information for improving the videodiscs, rather than to test the videodiscs against other methods of instruction. Until each videodisc is at its best, it is inappropriate to compare it to other instructional modes.

2) The design allowed faculty members to use the discs in whatever manner they judged appropriate, rather than imposing constraints on how the insitutions should use the

disc. In this way, the evaluation can address a disc's performance in actual institutions and curricula.

3) The design entailed collecting general information about a variety of topics, rather than detailed information about a few. Since there are few precedents for evaluative outcomes in assessing a new technology like videodisc, collecting a range of data allows the broadest view of operations.

In sum, this evaluation was exploratory and global, relying on qualitative methodology rather than using experimental designs. Experimental hypothesis testing is more appropriate after the videodiscs have been refined and improved to be their best.

Focus of the Evaluation

Evaluative data were collected from students, instructors, content experts, and others by means of surveys, interviews, observations, and anecdotal reports. These data focused on five areas: quality of a given disc, student outcomes, faculty and student acceptability, costs, and potential and problems of videodisc as a medium of instruction.

The quality of the disc. Because of the evaluation's formative emphasis, data were gathered to determine the strengths and weaknesses of each disc. In evaluating any new technology like videodisc it is critical that the quality of the specific product be examined, so that one can differentiate the users' response to the medium from their response to a specific instance. Respondents may be enthusiastic about the potential of the videodisc medium, but have reservations about a specific disc. We therefore developed guidelines that detail the features of an effective videodisc (see page 11). These guidelines formed the basis of the critique of each disc, as reported in Appendix A.

Student outcomes. The principal questions to be addressed regarding student outcomes were: How do students respond to this new medium? Does it increase their knowledge or interest in science? Do they prefer this method of learning? What are differences in outcomes for students who perform the experiment in a traditional lab and those who use a videodisc?

Faculty and student acceptability. Innovations in higher education depend on acceptance by faculty (Lindquist, 1978) and can fail if faculty reject them. Faculty acceptance is influenced by an innovation's compatibility with existing curriculum or teaching style, cost, ease of implementation, the innovation's respect for faculty autonomy, and the effectiveness of the technology. Students are influenced by compatability with the curriculum, and by ease of use, economy of time, entertainment value, and effectiveness.

Costs. To illustrate the costs involved in using videodisc technology, the evaluation included a preliminary cost comparison between a respiration experiment conducted in a traditional laboratory and one conducted through videodisc. Respiration was selected because of its prevalence in the

Guidelines for Evaluating an Interactive Science Videodisc

1. How does the videodisc's content coverage compare with the appropriate traditional laboratory experience on the same topic?
   - relative emphasis on manipulation, observation, interpretation, application, exploration
   - amount of guidance and instruction provided
   - stress on problem solving and critical thinking

2. To what extent can the user control:
   - time allowed for solving problems or answering questions
   - pace at which display material is presented
   - choice of sequence so user is not confined to a single track or linear path (effective branching)
   - point of entry into the program
   - ease of exiting an activity at any time
   - ease of reviewing material and receiving help or instructions

3. Is the user provided with adequate feedback?
   - feedback is nonthreatening, immediate, timely, reinforcing, remediating
   - feedback is given after correct and incorrect answers
   - help or assistance is built into the program
   - wrong answers are explained and corrected

4. Is the medium used to its potential?
   - what proportion of the content is presented in visual form, text, audio?
   - are visuals creative and engaging?
   - can computer-generated material be easily updated or changed?
   - are video and computer appropriately coordinated?
   - are audio and computer appropriately coordinated?

5. Does the program follow sound pedagogical principles?
   - are brief objectives specified at the beginning of the lesson?
   - can users assess their knowledge at the start (pretest)?
   - are there opportunities for remediation on prerequisite skills or knowledge?
   - does the lesson build from basic concrete concepts to advanced, formal or abstract ideas?
   - is a variety of explanations given?
   - are key concepts emphasized and highlighted?
   - has tedium been avoided?
   - does the lesson call for more than hitting the return key (page turning)?
   - is a variety of questioning formats used?
   - do questions reflect recall, comprehension, analysis, synthesis, evaluation?
   - can users assess their knowledge at the end (posttest)?

6. How does the videodisc compare with other methods of delivering the same content? Competitors include:
   - film, slide-tape program, other audiovisual packages
   - lecture
   - traditional laboratory
   - textbook material
   - written description of videodisc presentation
   - interactive computer instruction without videodisc images

college biology curriculum as a traditional lab and because respiration experiments entail the use of materials, organisms, and lab equipment.

Potential and problems of videodisc as a medium of instruction. Researchers have begun to report on the effectiveness of videodisc instruction (see, among others, Bork, 1981-82; Kearsley, 1981; Kadesch, 1980-81; Hoekema, 1983). The analysis of the medium's advantages and disadvantages presented in this report is based on both a review of the literature and the data collected during the evaluation.

Methodology

Data were collected from students and instructors during summer and fall, 1983, and spring 1984, at seven universities and colleges: University of Nebraska, Lincoln; University of Wisconsin, Madison; University of California, Berkeley; UCLA; Emporia State College, Kansas; Kansas State University; Illinois Central College.

The tables on the next page describe the designs and student sample sizes at each field test site:

Respiration

	Videodisc	Trad. Lab	Design
Berkeley	45	10	Student volunteers
Nebraska	37	32	Random assignment
Emporia	53	37	Random assignment

Climate and Life

	Videodisc	Trad. Lab	Design
Berkeley	17	*	Student volunteers
Nebraska	38	28	Random assignment
Emporia	40	44	Random assignment

Chemical Decision Making

	Videodisc	Trad. Lab	Design
Wisconsin	5	0	Student volunteers
UCLA	10	0	Student volunteers
Nebraska	6	0	Student volunteers

Titration

	Videodisc	Trad. Lab	Design
Wisconsin	6	7	Student volunteers
UCLA	14	25	Student volunteers
Nebraska	34	0	Student volunteers

Motion

	Videodisc	Trad. Lab*	Design
Kansas State	9		Student volunteers
Illinois Central	30		Course requirement

Energy

	Videodisc	Trad. Lab*	Design
Illinois Central	61		Course requirement
Nebraska	100		Student volunteers

(*No comparable traditional lab available.)

Data were collected from nearly 700 students (506 videodisc and 183 laboratory students) and 45 faculty members.

instructors, and content experts. Ten different questionnaires, observation forms, and interview protocols were used. Anecdotal reports and a review of the literature supplemented evaluation data.

I would like to acknowledge individuals who worked on various aspects of this evaluation: Maureen Asch, Dr. Larry Braskamp, Dr. Vicki Brazeale, Beverly Cabello, Steve Chin, Tim Erickson, Judy Hirabayashi, Phil Johnson, Denise Kiser, Dr. Dan Lapsley, Dr. Ron Serlin, Dr. Ann Smith, Dr. Elizabeth Stage, Joanne Stein, and Lynn Wood. Their hard work and pertinent contributions enriched this evaluation.

Cautions in Interpreting the Findings

The results described in this report should be interpreted with the following caveats. First, the discs often arrived at the field test sites out of sequence with the curriculum. Sometimes students viewed the discs months after they had studied the topic in their classes or months before the major concepts were presented. In addition, scheduling was often problematic. Discs were shown late in the day or at awkward times. How these factors affected students' responses to the videodisc lessons is unknown.

Second, the same students and instructors at each site did not view all the videodiscs. Thus it is inappropriate to make comparisons across videodiscs, for example, comparing the biology videodiscs to the chemistry or physics discs.

Third, videodisc presents users with a new mode of instruction. Faculty, comfortable with the control they have when lecturing, may react negatively to an instructional method that is perceived as taking something away from the teacher.

Fourth, a review of the data suggests that these discs were less well-received at research universities than at smaller colleges. Large research institutions typically have greater resources, and faculty may feel that they can do the job as well as or better than a videodisc lesson. In contrast, instructors at smaller institutions with limited resources may view videodisc instruction as a good way to enrich their curriculum. Most of my observations and informal interviewing of faculty members took place at research universities (because of geographical proximity and timing), and these evaluation results may overemphasize the perspective of research institutions.

Site by Site Analyses

As a first step, the questionnaires soliciting students' reactions to the videodiscs were statistically analyzed by institution using chi-square.

Respiration. There were only a few meaningful differences across the three sites (Berkeley, Nebraska, and Emporia) for this videodisc.

Design: Students at Berkeley volunteered to view the disc; students at Emporia and Nebraska were required to complete the disc lesson.

Student demographics: For some of the Berkeley students, English was their second language, while at Emporia and

Nebraska, English was all viewers' first language. Nebraska had more undeclared majors than the other two institutions.

Average time spent viewing the videodisc: Students at Berkeley spent less than 40 minutes; students at Emporia spent approximately 80 minutes; students at Nebraska viewed the disc for about 102 minutes. One possible explanation for the longer viewing time at Nebraska is that students viewed the disc in groups of three or more. At the other institutions, viewers tended to work individually or in pairs. Scheduling might also explain these results. Students at Berkeley were scheduled in one-hour blocks. More time was allowed at the other institutions.

Reported incidents of problems using the videodisc: At Berkeley 28% of the students indicated they had difficulties with the hardware or software. At Emporia, 15% of the students had problems. At Nebraska, 16% of the students reported problems. Berkeley students felt that some of the explanations were unclear and the worksheets were confusing, which prevented them from working smoothly through the disc.

Student response: Students at Nebraska seemed more positive about the videodisc than did students at other sites. While the differences on questionnaire items were small in number, the trend was for students at Nebraska to express greater satisfaction. For example, students were asked to indicate whether they would rather learn this material in a regular lab. Mean responses are shown below where 1 is interpreted as "no, not at all" and 5 is interpreted as "yes, very much." (Results are statistically significant at .003.)

Berkeley	3.7
Emporia	3.5
Nebraska	2.0

Student reaction to a new educational product is often more positive at the site where it was developed than at other institutions with no investment in the innovation (Scriven, 1980).

Climate and Life. The differences among the three institutions (Berkeley, Nebraska, and Emporia) observed for the Respiration videodisc were also apparent for Climate and Life. Students at Nebraska spent more time on the videodisc on the average than students at other sites, again most likely because they worked in groups. Students at Nebraska reported higher levels of interest and attention and more satisfaction with the videodisc than students at other sites. Larger percentages of students at Berkeley and Emporia (27% and 31%) reported difficulties with hardware and software than did students at Nebraska (20%).

Titration. Few statistically significant differences existed across the sites (UCLA, Wisconsin and Nebraska) for Titration.

Student demographics: Wisconsin had more non-native speakers than the other sites; UCLA students had lower grade point averages than either Wisconsin or Nebraska.

Average time spent viewing the disc: Students at UCLA spent 26 minutes, at Wisconsin 54 minutes, and at Nebraska 50 minutes. Most students worked alone or in pairs on Titration. Differences in viewing time may reflect differences in the reported incidence of problems with the videodisc: Students at Nebraska reported more difficulties than students at other sites: 48% had problems, compared with 21% at UCLA and 33% at Wisconsin.

Student response to the videodisc: In general, no statistically significant differences existed across the sites in levels of satisfaction or interest in the Titration lab. Where differences were observed, students at Nebraska tended to be slightly less positive about the videodisc, a finding that is perhaps linked to their higher incidence of problems with the equipment.

Chemcial Decision Making. This disc was field tested at UCLA, Wisconsin, and Nebraska. Sample sizes were relatively small at each institution and so these results should be interpreted cautiously. Differences across sites for this videodisc include:

Student demographics: UCLA had a larger number of students who had learned English as a second language.

Average time spent viewing the disc: 82 minutes for Nebraska, 27 minutes at UCLA, 25 minutes at Wisconsin; in addition, students at Nebraska had more viewing sessions than students at UCLA or Wisconsin.

Reported difficulties with the videodisc were higher at Wisconsin (40%) than at the other sites (about 20%). Level of interest and attention and satisfaction were about the same across sites; there were no statistically significant differences.

Motion. Students at two sites viewed this videodisc: Illinois Central College and Kansas State.

Design: At Kansas students volunteered to view the disc; it was required at Illinois Central.

Student demographics: No women completed evaluation forms at Kansas.

Average time spent viewing the disc: Students at Illinois Central seemed to find the disc more challenging and difficult; they spent 162 minutes (compared to 133 minutes for Kansas students) and indicated that they needed even more time.

Reported incidence of problems with the videodisc: Over 60% of the students at both institutions reported difficulties working the videodisc, primarily with the software. Students felt that the programming was intolerant of imprecise responses, and this hindered their progress through the disc.

Student response: There were no differences in student reactions to the videodisc between the sites.

Energy Transformation. Data were collected from students at Illinois Central College and Nebraska.

Design: Students at Illinois Central were required to view the videodisc; it was optional for those at Nebraska, although they received bonus points.

Student demographics: Students were generally similar in their demographic characteristics, although Illinois Central had more non-Engineering and Physical Science majors.

Average time spent viewing the disc: Students at Nebraska spent more time viewing the disc and did so on more occasions. The average viewing time for Nebraska students was 200 minutes, 100 minutes for Illinois Central students.

Reported incidence of problems with the videodisc: Both groups reported interference by the hardware, software or equipment (46% at Nebraska; 39% at Illinois).

Student response: In general, students at Nebraska reported slightly greater interest, attention and satisfaction with the videodisc.

Discussion. There were some differences across the sites on some questionnaire items, but there was no consistent trend or pattern across all discs. One general impression: research institutions seem to be more critical of the discs than other colleges. Statistically significant differences are most likely due to a variety of factors, including whether the disc was required viewing; students' demographic characteristics; problems with hardware, software, or equipment; and how the disc was presented to students by the instructor.

Given the amount of data collected, the wide variations in sample sizes at each site, and the exploratory nature of this evaluation, I decided to combine questionnaires across sites for the rest of the chi-square analyses. Where site differences are statistically significant and meaningful, they are discussed in the body of this report.

QUALITY OF THE VIDEODISCS

Reported here are some general comments on the quality of the videodiscs based on the reactions of the faculty, students, and content experts who viewed them. Detailed critiques and suggestions for improving the videodiscs appear in Appendix A. Complete questionnaire results and open-ended comments from students and instructors for each of the videodiscs are reported in Appendix B, which is separately bound. A comparison of videodisc to the traditional lab is discusssed in a later section, "Comparison of Videodisc and Laboratory Experiments."

Biology Videodiscs

Eight biology instructors and 135 students viewed the Respiration videodisc; eleven biology instructors and 95 students viewed Climate and Life. Viewers were asked to comment on the quality of the content, the instructional features, appropriate audience, and overall value of the videodisc.

Quality of content. The students' and instructors' ratings of the challenge and difficulty of each of the biology videodiscs are shown below, where 1 = too easy, too elementary and 5 = too hard, too advanced. Mean ratings are reported.

	Respiration		Climate & Life	
	Students	Staff	Students	Staff
Challenge of lesson	2.8	2.4	2.9	3.1
Amount of new information	2.7	2.5	2.9	2.8
Level of information	2.8	2.5	2.8	3.2

Neither videodisc was viewed as too difficult by students or staff. Students found Respiration more challenging than did staff; staff felt Climate and Life was more advanced than did students. In general, the reactions of both groups to both discs were similar.

Instructors were asked to evaluate the videodisc content across a number of dimensions. Their mean ratings are shown below, where 1 = very poor and 5 = excellent.

	Respiration	Climate & Life
Accuracy of scientific information	3.8	3.0
Appropriate use of examples	3.7	2.5
Currency of scientific information	3.6	3.4
Appropriate reading/vocabulary level	3.5	3.3
Completeness of topic coverage	3.4	2.3
Pedagogical principles employed	3.3	2.6
Likelihood of promoting student understanding	3.1	2.2
Sophistication of logic and reasoning	2.8	2.9
Potential to motivate/interest students	2.8	3.0
Sophistication of science content	2.6	3.2
Likelihood of provoking higher-order thinking	2.3	2.2

In general, instructors tended to give higher ratings to Respiration than to Climate and Life; item differences, however, are not statistically significant. Respiration's strengths include the accuracy and currency of scientific information, appropriate use of examples, and level of vocabulary. However, it was viewed as being relatively unsophisticated and unlikely to provoke higher-order thinking.

None of the mean ratings for Climate and Life were above 3.4, and instructors gave low marks to its use of examples, completeness of coverage, pedagogy, and the likelihood that the disc would either promote student understanding or higher-order thinking.

Instructors' open-ended comments support their ratings. They found inaccuracies in Climate and Life and made suggestions for improving the disc. Respiration received less criticism. (See Appendix A for suggestions for revising each disc.)

Instructional features. Both students and staff rated instructional features of each videodisc. Their mean responses are shown below, where 1 = very poor and 5 = excellent.

	Respiration		Climate & Life	
	Students	Staff	Students	Staff
Opportunity to work at own pace	4.1	4.3	4.1	3.0
Readability of text	3.9	3.8	4.0	2.5
Instructions on using videodisc	3.8	3.4	4.0	3.1
Opportunity for feedback	3.7	3.3	3.5	2.9
Explanations	3.5	2.8	3.1	2.9
Quizzes	3.5	2.8	3.2	3.0
Visual images	3.5	3.6	4.1	2.8
Student worksheets	3.5	3.0	3.4	2.4
Instructor's manual		3.0		2.2
Opportunity to skip parts of the lesson	3.4	2.8	3.7	2.9
Opportunity to review	3.3	3.0	3.9	2.7

Students were more generous in their ratings than instructors; both tended to be more positive about Respiration than about Climate and Life. Features that were especially valued include the self-pacing aspects, the opportunities for feedback, and visualization.

Comparison of videodisc with other instructional methods. A series of questions to instructors probed their expectations for the videodiscs and how the videodiscs compared to other types of instruction. Mean responses are shown below, where 1 = not nearly as good and 5 = much better.

How does this videodisc compare with:

	Respiration	Climate & Life
Your expectations of it	2.6	1.9
Standard textbook presentations	2.5	2.6
Lab manual presentations	2.4	2.3
The experience of a lab	1.5	1.3

Instructors seemed more disappointed with Climate and Life than with Respiration. Other ratings for both videodiscs were similar. In general, instructors felt that these videodiscs were not necessarily better than the standard textbook or lab presentation and not as good as the experience of a lab itself. Note, however, that material in Climate and Life is not normally included in a lab and so staff's response to this question should be interpreted cautiously.

Audiences for these videodiscs. Instructors were asked to indicate the most appropriate audience for the two discs. The percentage of respondents indicating each group is listed below.

	Respiration	Climate & Life
Adults in off-campus learning situation	63%	46%
Students learning independently in library or learning center	63%	54%
High school students	50%	73%
College freshmen/sophomores	50%	91%
College juniors/seniors	13%	36%
Students well-prepared in math/science	38%	9%
Students poorly prepared in math/science	25%	46%

Almost two-thirds of the respondents considered Respiration as appropriate for independent or off-site learning, and approximately half felt the same about Climate and Life. Instructors felt Climate and Life to be especially appropriate for high school or beginning college students.

Overall production quality and value. Students and instructors rated the overall production quality of each disc, and staff judged the disc's educational value. Mean responses are shown below, where 1 = very poor and 5 = excellent.

	Respiration		Climate & Life	
	Students	Staff	Students	Staff
Production quality	3.8	3.8	3.9	2.7
Overall value		2.5		2.5

Students and staff rated production quality high for Respiration. Instructors felt Climate and Life was technically lower. Faculty gave both discs the same relatively low overall rating.

Chemistry Videodiscs

Ten chemistry instructors and 55 students viewed the Titration videodisc; four instructors and 21 students completed forms on Chemical Decision Making.

Quality of content. The mean ratings for challenge and difficulty of each of the chemistry videodiscs are shown below, where 1 = too easy, too elementary and 5 = too hard, too advanced.

	Titration		Chemical Decision Making	
	Students	Staff	Students	Staff
Challenge of lesson	2.9	3.3	3.5	3.5
Amount of new information	3.0	3.1	3.0	3.0
Level of information	3.0	2.8	3.0	3.0

Students and staff rated Chemical Decision Making as more challenging than Titration. In general, the reactions of both groups to both discs were similar. The discs are neither too difficult nor too elementary.

Instructional staff were asked to evalute the videodisc content across a number of dimensions. Their mean ratings are shown below, where 1 = very poor and 5 = excellent.

	Titration	Chemical Decision Making
Accuracy of scientific information	4.4	4.3
Currency of scientific information	4.3	4.3
Appropriate use of examples	4.0	3.5
Appropriate reading/vocabulary level	3.7	4.0
Completeness of topic coverage	3.7	3.5
Sophistication of logic and reasoning	3.2	3.8
Sophistication of science content	3.2	3.7
Pedagogical principles employed	2.8	3.3
Likelihood of promoting student understanding	2.8	3.3
Potential to motivate/interest students	2.8	3.8
Likelihood of provoking higher-order thinking	2.5	3.8

In general, instructors gave higher ratings to Chemical Decision Making than to Titration, though no individual item comparisons were statistically significant. They judged Chemical Decision Making to be accurate, up-to-date, at an appropriate vocabulary level, sophisticated in its reasoning and logic, and likely to interest students and provoke higher-order thinking. Titration was also considered scientifically accurate and current, and examples were used appropriately. Some of the viewers felt that this disc was less strong in pedagogy and unlikely to promote higher-order thinking.

Instructional features. Both students and staff rated various instructional features of each videodisc. Mean responses are shown below, where 1 = very poor and 5 = excellent.

	Titration		Chemical Decision Making		
	Students	Staff	Students	Staff	
Opportunity to work at own pace	4.5	4.3	4.1	4.5	✓
Opportunity to skip parts of the lesson	4.2	3.3	3.3	3.5	✓
Visual images	4.1	3.2	3.5	3.5	✓
Opportunity to review	4.0	3.7	3.5	3.0	✓
Opportunity for feedback	3.9	3.2	3.4	2.8	
Readability of text	3.9	3.8	3.5	4.0	✓
Explanations	3.8	3.3	3.0	2.3	
Instructions on using videodisc	3.6	3.3	3.8	3.0	
Quizzes	3.3	1.7	2.9	2.7	
Student worksheets	3.2	3.6	2.4	3.0	
Instructor's manual		3.7		3.0	

Students were more generous in their ratings than were instructors and tended to rate Titration higher than Chemical Decision Making. Staff rated both discs high on self-pacing and interactivity. They faulted Chemical Decision Making on its explanations and Titration on its quizzes.

Comparison of videodiscs with other instructional methods. Instructors were asked to compare the videodisc with several different instructional methods. Mean reponses are shown below, where 1 = not nearly as good and 5 = much better.

How does this videodisc compare with:

	Titration	Chemical Decision Making
Your expectations of it	2.3	4.2
Textbook presentations	2.9	3.0
Lab manual presentations	3.0	3.0
The experience of a lab	2.7	1.2

Chemical Decision Making was viewed more positively than expected; Titration less than expected. In both cases, instructors felt these discs were not replacements for laboratory experiences but compared favorably with written material such as textbooks and lab manuals.

Audiences for these videodiscs. Instructors were asked to indicate the most appropriate audience for the two discs. The percentage of respondents indicating each group is listed below.

	Titration	Chemical Decision Making
High school students	100%	100%
College freshmen/sophomores	50%	100%
College juniors/seniors	20%	—
Students poorly prepared in math/science	30%	—
Students well-prepared in math/science	30%	25%
Students learning independently in library or learning center	40%	75%
Adults in off-campus learning situations	30%	25%

Respondents tended to agree that the discs are appropriate for high school students and lower-division students. Chemical Decision Making was viewed as being more appropriate for independent learning than was Titration.

Overall production quality and value. The mean ratings of students and staff are shown below, where 1 = very poor and 5 = excellent.

	Titration		Chemical Decision Making	
	Students	Staff	Students	Staff
Production quality	4.1	3.9	3.6	3.8
Overall value		2.9		3.5

Production quality was judged good for both discs. Instructors' ratings of overall value correspond to their ratings of these discs on individual dimensions: they were more positive about Chemical Decision Making than Titration.

Physics Videodiscs

Five instructors and 39 students viewed the Motion videodisc; seven instructors and 161 students completed evaluation forms on the Energy videodisc.

Quality of content. Students' and instructors' mean ratings on the challenge and difficulty of each physics videodisc are reported below, where 1 = too easy, too elementary and 5 = too hard, too advanced.

	Motion		Energy	
	Students	Staff	Students	Staff
Challenge of lesson	2.8	2.5	3.0	2.6
Amount of new information	2.6	2.5	2.6	2.4
Level of information	2.8	2.5	2.9	2.4

Students' and instructors' ratings are similar for each disc. The videodiscs are at the appropriate difficulty level for students who had previously covered the content in their physics courses.

Instructional staff were asked to evaluate the videodisc content across a number of dimensions. Their mean ratings are shown below, where 1 = very poor and 5 = excellent.

	Motion	Energy
Accuracy of scientific information	4.0	3.6
Currency of scientific information	3.6	3.2
Appropriate use of examples	3.6	3.4
Appropriate reading/vocabulary level	3.6	3.0
Completeness of topic coverage	3.4	3.0

	Motion	Energy
Likelihood of promoting student understanding	3.2	3.4
Pedagogical principles employed	3.2	3.3
Potential to motivate/interest students	3.2	2.8
Sophistication of science content	3.0	3.0
Sophistication of logic and reasoning	3.0	2.8
Likelihood of provoking higher-order thinking	2.6	3.3

Instructors' ratings were generally similar for both discs. Motion was rated high on accuracy and currency of scientific information, use of examples, and completeness of topic coverage. Energy had some of these same strengths.

Instructional features. Both students and instructors rated each videodisc across a number of dimensions. Mean responses are reported below, where 1 = very poor and 5 = excellent.

	Motion		Energy		
	Students	Staff	Students	Staff	
Opportunity to work at own pace	4.1	4.2	3.8	3.2	✓
Readabilty of text	4.1	3.7	4.2	3.3	✓
Visual images and action	4.1	3.3	4.1	3.8	✓
Instructions on using videodisc	3.8	3.8	3.6	3.3	✓
Opportunity for feedback on answers	3.5	2.8	3.3	2.8	
Explanations	3.5	3.2	3.0	3.3	✓
Quizzes	3.3	3.3	3.2	2.3	
Student worksheets	3.3	3.7	3.2	4.0	✓
Opportunity to review parts of lesson	3.1	3.8	3.5	3.0	✓
Opportunity to skip parts of lesson	2.3	3.2	3.3	1.5	

Students appreciated the opportunity to work at their own pace and the technical quality of the videodiscs. However, they were less enthusiastic about interactive features of the discs: opportunities to skip or review parts of the lesson; opportunities for feedback on answers; quizzes and explanations. Staff gave the discs generally positive marks with a few exceptions. Motion was rated weak on opportunity for feedback on answers. Energy received low marks on quizzes, opportunity to skip parts of the lesson, and opportunity for feedback.

Comparison of videodiscs with other instructional methods. Instructors were asked to compare the videodiscs with several different instructional methods. Mean responses are shown below, where 1 = not nearly as good and 5 = much better.

How does this videodisc compare with:

	Motion	Energy
Your expectations of it	3.4	2.4
Textbook presentations	2.8	2.7
Lab manual presentations	3.3	2.7
Experience of a laboratory	2.6	2.4

Instructors seemed more disappointed by Energy than Motion. They judged Motion to be better than a lab manual poresentation, but neither disc was considered better than textbook presentations or the experience of a lab.

Audiences for these videodiscs. Instructors were asked to indicate the appropriate audiences for the two discs. The percentage of respondents indicating each group is listed below.

	Motion	Energy
High school students	60%	57%
College freshmen/sophomores	60%	71%
College juniors/seniors	—	14%
Students poorly prepared in math/science	40%	29%
Students well prepared in math/science	20%	43%
Students learning independently in library or learning center	40%	57%
Adults in off-campus learning situations	60%	43%

Respondents viewed both Motion and Energy as appropriate for high school and lower-division students. About half the respondents viewed the discs as appropriate for off-site or independent learning.

Overall production quality and value. The mean ratings of students and staff are shown below, where 1 = very poor and 5 = excellent.

	Motion		Energy	
	Students	Staff	Students	Staff
Production quality	3.9	4.0	3.9	3.8
Overall value		3.2		2.9

Production quality was judged as good for both discs by students and staff. Instructors' ratings of overall value correspond to their ratings of specific aspects of these discs: they viewed Motion more favorably than Energy.

STUDENT OUTCOMES

Characteristics of Students Who Viewed the Videodiscs

At some field sites, students were randomly assigned to either the videodisc or the traditional laboratory. At other sites, students volunteered to view the videodisc, either before or after they had conducted a traditional lab experiment on the same topic. For one site, viewing the disc was mandatory. Demographic and other data were collected from all students who completed evaluation forms.

Students who viewed the discs were enrolled in science courses, typically the introductory course of the discipline. More than one-third of the students who viewed the biology discs were science or engineering majors. About three-quarters of the students who viewed the chemistry or physics discs were majoring in science or engineering. The percentage of students in each discipline for each disc is shown below.

	Biological/ Physical Science	Engineering	Other Major	Undeclared
Respiration (N=135)	35%	5%	40%	20%
Climate & Life (N=95)	36%	1%	41%	22%
Titration (N=55)	54%	25%	12%	9%
Chem. Dec. (N=21)	45%	25%	25%	5%
Motion (N=39)	28%	46%	21%	5%
Energy (N=161)	12%	83%	5%	1%

Demographic characteristics. More women than men viewed the biology videodiscs; the reverse was true for the physics and chemistry discs. Our observations revealed no noticeable differences in how male and female students used or responded to the videodiscs.

Over 80% of the viewers reported English as their first language. Observations and evaluation forms revealed that some students who were not fluent in English had difficulty in understanding some of the videodiscs, but because sections of the disc could be repeated these students had the opportunity to review material they missed the first time.

Skills and knowledge. Most students were relatively unskilled in using either a videodisc player or a microcomputer, but they rated themselves as proficient typists. Our observations showed that most students managed the equipment and hardware with relative ease.

About half the students viewing the videodiscs indicated that they had not previously covered the material in their courses. Those who were familiar with the content used the videodiscs as an opportunity to explore concepts in more depth or to clarify ambiguities. As a supplementary investigation, student reactions to each videodisc were analyzed according to whether they had previously studied the material in another course.

There were only a few differences on some items on some discs but no consistent trends. For example, one might expect that students who had studied the material previously would spend less time with the videodisc. But the data do not uniformly support this expectation:

Average Amount of Time Spent on Videodisc

	Students Unfamiliar With Topic	Students Familiar With Topic
Respiration	81 minutes	61 minutes
Climate and Life	101	98
Titration	44	47
Chem. Dec. Making	58	19
Motion	174	147
Energy	165	163

Although students who had previously studied Respiration, Chemical Decision Making, or Motion spent less time on the videodisc than their counterparts who were studying the material for the first time, for Climate and Life, Titration, and Energy, both groups spent about the same time working through the videodisc.

Students' familiarity with the material did not affect their self-reported levels of attention or interest in the videodisc or their ratings of the videodiscs' difficulty, with one exception. For Chemical Decision Making, students familiar with the content seemed less interested and attentive to the disc.

Both groups tended to rate the other questionnaire items similarly across discs. The differences that did occur seem inconsequential or spurious: for example, on the Climate and Life disc, students who had previously studied the material rated the visual images lower than did students unfamiliar with the topic.

Time Spent on Videodiscs

Students tended to spend only one session viewing the biology and chemistry videodiscs. But the physics discs are specifically designed to encourage multiple viewing sessions, and over half the students viewed these discs in two or more sessions.

Students were asked to indicate the number of minutes they spent on the videodisc. Mean responses are reported below:

Mean Time Spent Working on Videodisc

Respiration	72 minutes
Climate & Life	100 minutes
Titration	45 minutes
Chemical Decision Making	42 minutes
Motion	155 minutes
Energy	163 minutes

Students spent less than one hour on each of the two chemistry videodiscs, between one and two hours on each biology videodisc, and over two hours on the physics discs, which reflects the multiple viewing sessions. Some of these data reflect scheduling constraints: at UCLA (chemistry), Wisconsin (chemistry), and Berkeley (biology), students were scheduled in one-hour blocks. At the other sites, students had more freedom to view the discs at length.

Reasons for Participating

Students who volunteered to view the discs were asked to indicate why they chose to participate. Mean responses are shown below, where 1 = not an important reason and 5 = very important reason.

	Respiration (N=45)	C&L (N=17)	Titration (N=54)	Chem. Dec. (N=21)	Mot. (N=8)	Energy (N=93)
Recommendation of professor or TA	2.3	2.1	3.5	2.8	2.0	2.7
Recommendation of other students	1.9	2.1	1.6	1.5	1.6	1.5
To get additional help	1.6	1.9	3.2	2.8	1.5	1.6
To learn more about the subject	2.7	3.0	4.5	3.6	2.6	1.9
To do better in exams	2.0	2.2	4.1	3.4	1.8	2.0
Curiosity about videodisc	3.8	3.9	2.9	3.3	4.1	2.1
To obtain extra credit	1.8	4.3	1.4	1.4	1.8	4.9
As substitute for another assignment	1.7	3.1	1.4	1.7	4.6	1.7

Students who volunteered to view the biology videodiscs (viewers at UC Berkeley only—students at other sites were assigned to view them) did so primarily out of curiosity about this new instructional technology. One section, however, received extra credit to work through Climate and Life. Students who viewed the chemistry videodiscs had more pragmatic concerns: to learn more about the subject and to improve their test performance. They were also influenced by their professors' or Teaching Assistants' recommendations. Students who volunteered to view the physics discs did so to obtain extra credit or to use the discs as a substitute for another assignment. Students' reasons for viewing the discs do not reflect inherent differences in the discs but rather the way the discs were presented to students to solicit participation.

Effects on Students' Learning

To assess the effects of the videodiscs on student learning, some samples of their worksheets were examined, when available, and instructor's perceptions and students' self-reports were analyzed.

Test score information, however, was not formally collected although some test data are reported in the section, "Comparison of Videodisc and Laboratory Experiments." Extensive testing of student learning was considered premature at this stage of the discs' development, since these discs were the first versions of a new product and would inevitably be revised. Once the discs have been revised and improved, a study could be undertaken to determine the comparative effectiveness of this mode of instruction. The present evaluation sought to more generally investigate whether students could learn from this new technology. While it was originally planned to gather some quiz information by computer, the logistics of amassing and interpreting these data proved too difficult.

The review of worksheets from UC Berkeley (Respiration and Climate and Life) and Illinois Central (Energy) indicated that students were able to apply material presented on videodisc and to solve problems. Not all students chose to complete worksheets, especially those at sites where participation was voluntary. But worksheets that were returned showed that students were generally able to understand the concepts and ideas presented on videodisc.

Students were also asked several questions to identify the effects of the videodiscs on their learning of the material. In their open-ended comments (see Appendix B), students reported learning the following:

- Specific content related information, facts, or ideas including definitions, theorems, and major theses (for example, that velocity increases with time or that temperature affects respiration).
- Scientific processes (for example, how to record observations, the proper procedures for experiments, or the importance of making precise measurements)
- How to use videodisc equipment (working a microcomputer, using a videodisc player)
- Scientific reasoning (how to proceed logically, how to formulate and discard hypotheses)

Students were asked to rate the effectiveness of the videodiscs in promoting their understanding of certain scientific processes. Their mean responses are reported below, where 1 = not at all effective and 5 = very effective.

. How effective was the videodisc in helping you understand:

	Respiration	C&L	Titration	Chem. Dec.	Motion	Energy
Calculations	2.9	2.6	2.4	1.8	2.4	2.9
Results	3.5	3.1	3.3	2.9	2.9	3.2
Basic principles	3.6	3.5	2.9	3.4	3.4	3.6

Students felt that the discs were generally effective in helping them learn basic scientific principles. The videodiscs were perceived by students as differentially effective in aiding understanding of the results. However, not all the videodiscs required quantitative calculations or manipulations.

Finally, students were asked to indicate whether the videodisc provided a useful learning experience. Their mean ratings are shown below, where 1 = strongly disagree and 5 = strongly agree:

In light of the effort I put into it, I was satisfied with what I learned in this lab session:

Respiration	3.6
Climate & Life	3.2
Titration	3.4
Chem. Decision Making	3.1
Motion	3.1
Energy	3.2

In general, students seemed satisfied. They could identify specific concepts or ideas and felt that what they had learned was worth the effort they had made. In particular, these videodiscs seem most useful for helping students understand scientific principles and ideas.

Effects on Students' Attitudes and Interests

A series of questions probed the effects of the videodiscs on students' level of attention and interest in science.

Students were asked to compare the videodisc lab with their traditional science labs in that course. Mean responses are reported below, where 1 = lower, 3 = same, and 5 = higher.

Compared with other lab sessions in this course, how would you rate your:

	Respiration	C&L	Titration	Chem. Dec.	Motion	Energy
Level of attention	3.4	3.5	3.8	4.0	3.4	3.2
Interest in the content	3.4	3.4	3.6	3.8	3.2	3.3

The videodiscs captured students' attention and held their interest. In general, students were neither bored nor confused, and they seemed to enjoy working with the new technology. Although the discs represented only a small part of the course curriculum, students were asked to indicate whether viewing the discs increased their interest in science. Students judged this effect to be minimal. This result is not surprising, expecially since 40% to 80% of the respondents were science majors, that is, individuals with a declared interest in science.

Summary

In summary, students can learn from these videodiscs and can identify specific content, information, concepts, or ideas they gain from working through the interactive program. Students also report learning about aspects of scientific processes or reasoning. The videodiscs capture students' attention: students are neither bored nor confused as they work through the discs.

ACCEPTABILITY OF VIDEODISCS TO INSTRUCTORS AND STUDENTS

Instructors' Reactions

Of major importance is whether the new videodisc technology will be accepted and used by instructors as part of their course curriculum. Experience shows that faculty do not embrace an innovation solely on the basis of objective data or hard evidence of improved learning. For example, it is well documented (Kulik et al., 1979) that students learn more under the Personalized System of Instruction (PSI) than they do in a traditional lecture-discussion section, yet few institutions widely offer PSI. Similarly, although research (e.g., Fulwiler, 1982) shows that increasing the amount and kind of writing instructors require of their students improves students' understanding of the material, faculty in disciplines other than English are reluctant to assign written work (Walvoord, 1982). Among the many factors that affect faculty acceptance are: an innovation's fit with the course curriculum, its ease of use, and its compatability with a faculty member's sense of autonomy and educational philosophy.

A review of questionnaires and informal interviews with faculty members shows that instructors recognize the potential of videodisc technology. Some felt that a videodisc covering the same material as a traditional lab experiment was not an adequate substitute for the lab, but that well-conceived, high-quality discs could be a useful supplement. Instructors were more enthusiastic about using videodisc to provide experiences not possible in a traditional laboratory. The instructors' mean ratings of the general potential of the videodisc medium, where 1 = poor potential and 5 = excellent potential, are shown below:

Respiration (N=8)	3.0
Climate & Life (N=11)	2.8
Titration (N=10)	4.1
Chemical Decision Making (N=4)	4.0
Motion (N=5)	3.8
Energy (N=7)	4.5

Faculty were also asked to gauge the fit of the videodiscs with their course curriculum. Mean ratings are shown below, where 1 = poor fit and 5 = excellent fit:

Respiration	3.6
Climate & Life	3.1
Titration	3.6
Chemical Decision Making	3.7
Motion	3.0
Energy	3.2

The generally high ratings suggest that the content of these videodiscs would fit into the introductory course sequence of a standard biology, chemistry, or physics curriculum.

Instructors were also asked to indicate whether they would consider using the field-tested videodiscs or the videodisc medium in their courses. Mean responses are shown below, where 1 = not at all likely and 5 = very likely:

	Respiration	C&L	Titration	Chem. Dec.	Mot.	Energy
Use videodisc technology in teaching	2.5	1.9	2.4	2.3	2.4	3.3
Use this videodisc in teaching	2.3	1.5	2.2	2.8	2.4	3.1
Look for better discs on this topic	3.0	2.2	3.1	2.8	2.4	2.4
Look for discs on other topics	3.1	2.1	3.3	4.0	3.0	3.5

Instructors viewing the Energy disc were generally positive about using videodisc technology in teaching. The ratings for the other videodiscs are generally lower, perhaps because instructors found problems with these particular videodiscs that could limit their usefulness in teaching. Nevertheless, in their open-ended comments and in informal conversations, instructors speculate that they might use improved videodiscs in teaching. As one faculty member put it: "These videodiscs are in their infancy and we really can't judge their effectiveness or what they will be like after developers and instructors gain experience."

Students' Reactions

Observations revealed that students worked attentively through the videodiscs. They seemed curious about the new technology and interested in exploring its workings. Some students expressed disappointment in the videodiscs, expecting futuristic graphics or Star Wars special effects. Students were asked to agree or disagree with statements about the potential and acceptability of videodisc. Their mean responses are shown below, where 1 = strongly disagree and 5 = strongly agree:

	Respiration	C&L	Titration	Chem. Dec.	Motion	Energy
I would like more labs on videodisc.	3.3	3.3	3.8	3.2	3.5	3.1
I would rather learn this material in a regular lab than with a videodisc.	3.2	2.7	2.6	3.1	2.7	2.7
I could learn more through a "real" experiment.	3.3	3.0	3.2	3.9	2.7	2.9

Students indicated they would like more labs on videodisc. They also report prefering videodisc to a traditional lab. Site by site results, however, show statistically significant variation in students' responses to this question.

I would rather learn this material in a regular lab than with a videodisc:

	Respiration	C&L	Titration	Chem. Dec.	Motion	Energy
Berekely	3.7	3.3				
Emporia	3.5	3.4				
Nebraska	2.0	1.7	2.7	2.0		2.2
UCLA			2.6	3.6		
Wisconsin			2.1	3.4		
Kansas					2.4	
Illinois Central					2.8	3.5

For both biology discs, students at Berkeley and Emporia report prefering traditional lab to videodisc. For Chemcical Decision Making, students at UCLA and Wisconsin prefer lab. For Energy, students at Illinois also prefer lab. Regardless of the disc they viewed, students at Nebraska and Kansas tended to prefer disc to lab. And all students viewing Titration indicated that the disc version was preferable to lab.

Site differences also exist in students' perceptions of whether they could learn more through a "real" experiment.

I could learn more through a "real" experiment:

	Respiration	C&L	Titration	Chem. Dec.	Motion	Energy
Berekely	3.5	3.4				
Emporia	3.4	3.6				
Nebraska	2.4	2.1	3.2	3.2		2.5
UCLA			3.3	4.4		
Wisconsin			2.8	3.6		
Kansas					2.7	
Illinois Central					2.5	3.4

Students at Berkeley, Emporia, Nebraska (for Titration and Chemcial Decision Making), UCLA, Wisconsin (for Chemical Decision Making), Emporia, Illinois Central (for Energy), acknowledged that they would probably learn more through the traditional hands-on laboratory treatment of the same topic.

Summary

Student and faculty reactions indicate their belief in the videodisc as a medium of potential. Faculty were willing to consider using high- quality well-developed discs in their teaching, and students were attracted to the medium and attentively worked through the videodiscs.

COMPARISON OF VIDEODISC AND LABORATORY EXPERIMENTS

The videodiscs in biology and chemistry simulate experiments that can be conducted in a traditional hands-on wet laboratory format. This section describes the differences between those two modes of instruction, based on on-site observations and questionnaire data. Results for Respiration and Climate and Life, traditional lab and videodisc, reflect the randomly assigned sites only (Nebraska and Emporia).

Time

Students report taking less time to perform the videodisc experiment than to carry out a comparable experiment in a traditional laboratory. Differences in time for the biology videodiscs were not statisticlly significant, however. The chart below summarizes the mean amount of time, in minutes, students actually spent conducting the experiment:

	Traditional Lab	Videodisc
Respiration	94 minutes (N=69)	85 minutes (N=60)
Climate & Life	119 minutes (N=72)	109 minutes (N=77)
Titration	130 minutes (N=32)	45 minutes (N=54)

During a conventional lab, students spend time setting up, waiting between data collection points, cleaning up, correcting errors, and so on. With a videodisc, the experiments can move more rapidly. For example, in Respiration, students need not wait for the temperature changes but can see results almost instantly.

Students who spent 40 minutes in the videodisc Respiration labs were able to carry out a complete experiment of one organism at three temperatures. Those who spent 60 minutes were able to test two or three organisms at three temperatures each, depending on the observation interval chosen. The striking difference for Titration time may be a result of scheduling factors or that Titration disc viewers were volunteers.

Content

Videodiscs enable students to examine a wider variety of conditions than is possible in a traditional lab. Students can explore more unknowns, investigate more organisms, and study many more biomes. Similarly, experiments can be performed across a wider range of conditions. For example, in respiration, students in a traditional three-hour laboratory had time to collect data for only three or four temperatures for one organism; students using the videodisc were able to study three organisms, over many temperatures within a two-hour session.

Procedures

Observations reveal that students using the videodiscs appeared less confused about what to do than students in the traditional lab, where more time was spent on procedures and busy work—setting up equipment, checking with the TA to make sure the experiment was accurately conducted, and correcting errors. In some cases, lab students were quite confused about procedures and equipment, but no similar confusion was apparent in the videodisc groups.

The videodisc medium provides a more structured and individualized approach than most traditional labs. Interactive preparation is obligatory, since students must work through introductory sections before conducting the experiment. In contrast, in a traditional lab, preparation tends to be left to students, with mixed results, or delivered as a pre-lab lecture during which students can remain passive or inattentive. Videodiscs can also better provide timely instructions, and the medium allows students to work at their own pace. In the traditional lab, with one Teaching Assistant and twenty to thirty students, students receive less individual monitoring and tutorial assistance. As a result, students cannot always receive timely clarification or correction.

Students' responses to the questionnaires support these observations. Their mean ratings are shown below, where 1 = strongly disagree and 5 = strongly agree:

I was confused most of the time [while doing this experiment]:

	Laboratory	Videodisc
Respiration	2.6	2.3
Climate & Life	2.4	2.3
Titration	2.8	2.4

Students who made procedural errors in performing the lab experiment missed the point of the lesson (for example, students who had trouble with the steps of the respiration lab did not learn the relationship between temperature and respiration). Because computer results are consistent, students using the videodisc were less likely to make errors and more likely to discover the major ideas or hypotheses.

Problems in Conducting the Experiment

While students in the traditional laboratory may have encountered difficulties because they were confused or disregarded instructions given by the TA, students using the videodiscs reported programming or software problems that hindered their completing the experiment.

The percentage of students indicating difficulties is shown below:

	Laboratory	Videodisc
Respiration	9%	10%
Climate & Life	13%	25%
Titration	22%	39%

Most of the complaints from students using the videodiscs relate to hardware failure or problems in the software (booting the program, garbage dumps, glitches, trapped in loops, being unable to answer questions or solve problems). At some sites, difficulties resulted from incorrect use of the hardware (the player and microcomputer were turned off and on in between uses; when the equipment was turned on, power surges affected the reliability of the equipment). Difficulties with the Titration videodisc resulted from some problems in operating the stopcock.

Discussion and Interaction

One striking difference between students in a lab and those using videodisc is in the amount of discussion, number of questions, and the interaction among students and between students and TA. In a lab, there is much more conversation, questioning, and discussion.

This difference can be explained in part by work procedures: students tend to work in groups in a traditional lab and individually on videodisc. Specifically, about half the students worked alone on the biology videodiscs, less than one-third in the traditional laboratory. And although the chemistry experiments were conducted individually in lab and on videodisc, in the wet lab students exchanged information and conversed about procedures.

Our observations indicate that the dyad condition is optimal for laboratory problem solving. Working in twos, partners tend to keep each other on track by discussing solution paths and rejecting each other's errors. While some wet labs are conducted in dyads, others are not. Working groups tend to be larger when the equipment is expensive (for example, the temperature-bath set-up in respiration) or when apparatus has been damaged through mishandling. In these large groups, interaction tends to be less productive. We observed that the groups tended to surrender responsibility for the experiment to one or two individuals, and off-task interactions occurred among the rest.

Disc labs, in contrast, can certainly be performed in dyads and need not succumb to the equipment-cost pressures that force traditional labs to use teams larger than two students.

We further observed that students in the traditional lab asked many more questions of the instructor. Students using the videodisc, however, often had no one to ask, and when someone was available, students' questions focused on content--on getting the right answer. In comparison, students in the lab asked broader questions and instructors responded more elaborately or engaged in the Socratic method to encourage students to find the answer on their own. Discussion in lab ranged over a wide number of topics: including setting up equipment, implication of errors, and special things to watch for. Other conversations, such as social discussions of sports, weather, and last weekend's activities, were also noted.

A human tutor is unquestionably superior to a machine tutor at present. But in actual lab situations, TAs often lack the time to monitor and instruct each student, while a computer is always present to monitor student progress. Furthermore, TAs are not always successful in delivering timely instructions and cautions about procedures, as can be seen in the incidence of errors, accidents, and breakage in labs.

In the lab, students were able to discuss with other students variations or special observations. With the videodisc, however, all students obtain consistent results each time and therefore do not experience the little quirks or idiosyncracies of lab work.

Task-oriented Behavior

Because videodisc provides fewer distractions for students, students appear more task-oriented and almost completely focused on conducting the experiment. Students in lab exhibited a wider variation in behavior, and time actually spent on the task was short. Some students focused on the experiment; but others seemed to be just marking time. In many cases, students became restless toward the end of the three-hour lab period. Videodisc students were allowed to stop the program at key places, and no restlessness or distracted behavior was observed.

Student Self-Sufficiency

Students using the videodisc made their own decisions, whereas some students in the traditional lab tended to rely on the TA as they worked through the experiment and were quite dependent on the TA's response and reaction. "Is this right?" was a common query. Students using the videodisc usually had no one to check with, and their fear of failure appeared to be lower since they knew they could immediately and easily repeat any procedure or step.

Student Learning

In a traditional lab, performing the experiment tends to overshadow the other phases of preparation and analysis. The videodisc lab, however, integrated all three phases of the lab experience (preparation, experimental observation, and analysis) and required students to be actively engaged in the preparation and the design of the experiment, including the choosing of variables and parameters.

Notably, students in traditional labs typically take their results home for analysis, thus breaking the strong and necessary link between the performance of the experiment and understanding of its outcome. This division of the experimental process is usually dictated by time constraints: students simply cannot set up, perform, and analyze an experiment within a three-hour lab. Since the videodisc experimental procedures took less time than their wet-lab counterparts, these students had time to immediately analyze their results and draw conclusions by completing the discs' analytic summary questions.

In addition to being actively engaged in all phases of a lab experience, students using videodisc may be exercising higher-level intellectual skills. Researchers report that traditional laboratory instruction generally does not foster higher-level cognitive outcomes (Hofstein and Lunetta, 1982; Reif and St. John, 1979). Reif and St. John (1979) note that after completing a lab, students recall manipulations but are "unable to articulate the central goal of the experiment, its underlying theory or basic methods. Thus despite several hours spent working with lab apparatus, many students seem to learn from this experience little of lasting value." In relieving students from having to manipulate apparatus, videodisc eliminates what appears to be the least important aspect of science instruction. If videodisc can replace lab manipulations with activities that produce a stronger link to cognitive outcomes, it could produce a more valuable educational experience.

When asked to report what they learned from the experiment, students who viewed the videodisc version did not differ much from students who worked in the traditional lab.

Both groups indicated that they gained specific knowledge or information and an understanding of scientific processes or reasoning. One obvious difference was that videodisc students reported learning how to use videodisc equipment, while students in the traditional laboratory indicated that they gained skills in manipulating scientific equipment, for example, a burette or manometer.

A series of questions to both groups of students probed the effect of the medium of instruction on their understanding of the material. Mean responses are reported below, where 1 = not at all effective and 5 = very effective.

How effective was the videodisc [or laboratory experiment] in helping you understand:

	Respiration		Climate & Life		Titration	
	Lab	Disc	Lab	Disc	Lab	Disc
Calculations	2.7	2.9	2.8	2.6	2.8	2.4
Results	3.4	3.5	3.2	3.1	3.1	3.3
Basic principles	3.3	3.6	3.5	3.4	3.1	3.9

In general, ratings in both groups were similar, except that students who viewed the Titration videodisc reported a statistically significant better grasp of the basic principles than did students who performed the laboratory work.

Students who viewed the videodisc and students who conducted the laboratory experiment tended to respond similarly to questions about the effect of the experience on their learning.

At Emporia, test score data were collected from a sample of students assigned at random to either the videodisc or lab condition. The chart below shows their quiz results, out of 50 points possible:

	Climate and Life					Respiration				
	N	Mean	S.D	t	P	N	Mean	S.D	t	P
Videodisc	22	40.5	3.9	3.79	.01	22	21.3	6.5	NS	
Lab	25	33.0	9.0			8	23.1	5.3		

There was no difference in performance between students who viewed the Respiration videodisc or conducted a lab in respiration. For Climate and Life, however, students who viewed the videodisc achieved higher test scores.

Student Attitudes and Interests

A series of questions examined whether students who viewed the videodisc evidenced greater satisfaction, confidence, or interest than those who performed the same experiment in a traditional laboratory setting.

Students' mean responses are shown below, where 1 = lower and 5 = higher.

Compared with other sessions in this course, how would you rate your:

	Respiration		Climate & Life		Titration	
	Lab	Disc	Lab	Disc	Lab	Disc
Level of attention	3.3	3.5	3.2	3.5	3.4	3.8
Interest in the content	3.4	3.4	3.2	3.4	3.2	3.6

There were no differences in ratings between students who viewed the videodiscs and those who did experiments on the same topics in a traditional laboratory.

Similarly, lab students and videodisc students seemed equally confident after completing the experiment, with one exception. Mean responses are reported below, where 1 = not at all confident and 5 = very confident.

How confident did you feel:

	Respiration		Climate & Life		Titration	
	Lab	Disc	Lab	Disc	Lab	Disc
Using the hardware or equipment	3.8	3.9	3.7	3.5	3.4	3.4
Conducting the experiment	3.6	3.7	3.4	3.4	3.2	3.1
Reporting results	3.6	3.7	3.2	3.0	2.1	3.0
Following instructions	3.3	4.0	3.6	3.9	3.4	3.7

Students who viewed the videodisc were statistically significantly more confident following instructions than their traditional lab counterparts. These findings most likely reflect the consistency of the computer presentation.

Finally, students were asked about their levels of boredom and interest in the subject area. Mean responses are shown below, where 1 = strongly disagree and 5 = strongly agree.

	Respiration		Climate & Life		Titration	
	Lab	Disc	Lab	Disc	Lab	Disc
I was bored most of the time [during this experiment].	2.7	2.6	2.4	2.1	2.6	1.8
My interest in science has increased because of this lab session.	2.5	2.5	2.4	2.4	2.6	2.6

Again, in general, students responded similarly, with one exception: students viewing Climate and Life were significantly less bored than their lab counterparts.

Instructors' Views of Lab vs. Videodisc

Staff were asked to compare the videodisc they viewed with a lab on a similar topic. In general, staff felt that the discs were not as good for students as the experience of a hands-on laboratory. The percent of instructors who felt that these videodiscs could replace a traditional lab is shown below:

Respiration (N=8)	0%
Climate and Life (N=11)	9%
Titration (N=10)	0%
Chemcial Decision Making (N=4)	0%
Motion (N=5)	0%
Energy (N=7)	57%

However, between 75% and 100% felt that the discs could supplement the laboratory experience. These findings should be interpreted with two caveats: First, instructors viewing a videodisc may be comparing the disc to an idealized vision of a traditional laboratory, rather than to the actual practice of a lab, which often tends to fall short of some of its goals. Second, the traditional lab's emphasis on real-time manipulation of apparatus, a necessary skill for experimentalists in a chosen scientific discipline, may be a chief consideration for some instructors. Introductory science courses, however, serve a more diverse group of students, many of whom will never again need to weigh a mouse or turn a stopcock, but who can benefit from an understanding of the scientific principles and practices. Yet as research, cited earlier, indicates, traditional labs are weakest at conveying underlying theory or intellectual skills. Videodiscs would seem to have the potential to better direct students' attention to the goals, purposes, and outcomes of a laboratory exercise.

Instructors were also asked to agree or disagree with broad statements about the relationship between videodiscs and laboratories. Their mean responses are shown below, where 1 = strongly disagree and 5 = strongly agree.

	Respiration	Climate & Life	Titration	Chem. Dec.	Mot.	Energy
Videodiscs can never really substitute for hands-on experience	4.5	5.0	4.1	3.3	3.8	3.8
Videodiscs provide students with opportunities they cannot have in lab	2.4	2.5	2.1	3.3	3.6	4.3
Videodiscs motivate students in ways a lab cannot	3.1	2.0	2.4	2.8	3.4	3.5

These results suggest that instructors see videodiscs primarily as supplements to lab instruction—not as replacements. Those who viewed the physics discs were more positive about the technology, recognizing its potential to motivate students and provide them with experiences they cannot achieve in a traditional lab.

Summary

Clear distinctions exist between the process of conducting an experiment on videodisc and performing it in a traditional laboratory. Students using videodisc worked through the experiment more quickly and covered a wider range of content; they appeared less distracted, evidenced less confusion over procedures, and exhibited more task-oriented behavior, a greater self-sufficiency, and more willingness to take risks. But they also engaged in less peer interaction or discussions with the TA, had fewer opportunities for in-depth explanations or elaborations of key points; and were unable to compare experimental findings with students who may have achieved different results.

There were no meaningful differences in students' self-reported learning or the effects of videodisc on their attitudes and interests. Students who viewed the Climate and Life videodisc, however, achieved higher quiz scores than students who conducted the traditional lab on the same topic. No differences existed in student performance for Respiration.

A large majority of instructors agreed that although the videodiscs were not an adequate substitute for traditional labs, they were a useful supplement to a hands-on lab. Specifically, some instructors argue that scientists work with real specimens, fraught with problems, errors, and inaccuracies, but that the videodisc, by relieving students of such problems also limits their exposure to real scientific activity.

While instructors were intrigued by the potential of videodisc as an instructional medium, they were not as enthusiastic as students about these particular videodiscs as substitutes for traditional labwork. But they recognized that the discs could be used before a lab to orient students to procedures, reveal the results to expect, and introduce a wider range of content than is possible in a traditional lab. The uses for the discs after an experiment include reinforcing learning, allowing experimentation, and enabling students to correct inaccuracies in their lab experiment.

COSTS

Currently, videodisc technology is expensive. Costs for developing and using discs are not well established (Lipson, 1980-81) and depend on a number of factors including ratio of film footage to still frames, the degree to which electronics and computer-generated graphics can be used to create still frames, the number of iterations carried out in the formative stage of development, the extent to which preexisting film footage can be used, the size of the development team working on the disc, the desired quality of the product, the production facilities used, and the type of production (studio or on location).

A review of the literature yielded several types of cost estimates:

- Production costs of an interactive videodisc range from $1,000 to $10,000 per videodisc minute (Kearsley, 1981);
- A half-hour interactive videodisc can cost $50,000 or more to produce (Hiscox, 1982);
- Mastering a videodisc costs between $2,000 and $3,000;
- Finished discs (once pressed and mastered) sell for $10 to $20 or more;
- A computer-controlled workstation costs between $3,500 and $5,000 (for example, the Apple IIe sells for $1,500, an interface costs $500, and a videodisc player about $2,000);
- Videodisc is more cost-effective than videotape when the required number of copies exceeds 150 (Kehrberg and Pollack, 1981);

- It takes $50,000 worth of floppy diskettes to store the same amount of data as one $20 videodisc (Hiscox, 1982).

Because videodisc is primarily a medium of individual interaction, its widespread use will depend on lowered costs, which will in turn depend on the vagaries of the videodisc industry. Some of the world's largest corporations were at one time involved in videodisc development but have since pulled out. Just recently, RCA abandoned production of videodisc players.

As others have pointed out (Hiscox, 1982), videodisc technology is unlikely to remain viable if sales continue to limp and production slows. The failure of videodisc in the consumer market would have serious implications for videodisc as an instructional tool. Since the education market is much smaller than the consumer market, the sales volume of consumer players and disc pressings may control the costs and availability of players and discs for education.
Costs of hardware are declining, however, and many colleges and universities are experimenting with videodisc. Over the last several years, the cost of microcomputers has decreased by 30%, and videodisc players cost 20% less. Moreover, the availability of interface devices to control a videodisc player by a microcomputer are becoming commonplace. It is as yet unclear how new technological developments, such as audio digital discs, will affect the videodisc market.

A formal complex cost analysis is beyond the scope of this evaluation, but to estimate the cost of videodisc instruction, we compared expenses of teaching respiration by traditional laboratory methods and by videodisc. Among the host of variables that could be incorporated into cost calculations, we assumed certain factors to be constant across the methods, for example, energy use, maintenance, obsolescence, and so on. Furthermore, our figures represent only gross estimates from the perspective of an institutional user; we excluded fixed one-time expenditures such as development costs for both methods.

Our cost comparisons for teaching respiration by lab and by videodisc were calculated per student workstation. Workstation was selected as the unit of analysis for two reasons. First, certain expenses are fixed per station not per student; for example, only one meter stick is needed per laboratory station. Second, the number of students per laboratory workstation varied by institution, from two to five.

Our observation data indicate that two students complete a traditional respiration lab in 1.2 hours; one student needs .6 hours to study respiration on videodisc.

The table on the next page summarizes costs of teaching respiration under three conditions:

1) as a traditional lab, with one organism at one temperature;
2) as a traditional lab that is comparable to videodisc, with three organisms at different temperatures;
3) and by videodisc.

Cost Per Workstation

	Traditional Lab (one organism at one temperature)	Lab Comparable to Disc (three organisms at different temperatures)	Disc
Space			
New	$10,500	$10,500	$3,000
Renovated	6,000	6,000	1,500
Personnel			
TA	31	63	2
Lab Prep	13	25	
Supplies & Equipment			
Nonrecurring	697	773	4,025
Recurring	28	36	0
TOTAL			
a. New Space	11,269	11,397	7,027
b. Ren. Space	6,769	6,897	5,527
c. Without Space	769	897	4,025
d. Recurring Costs of Materials	28	36	0
e. Recurring Costs of Personnel	44	88	2

If a user is building a new space or renovating an existing space, it is more expensive to provide wet-lab facilities than to install a videodisc system. If existing space is used, without any modifications, teaching respiration through a traditional lab is less costly than purchasing a videodisc system. However, the recurring costs of personnel and materials are much greater for a traditional laboratory than for videodisc. If existing space is used without any modifications and only an interface need be purchased (at about $500), teaching respiration by videodisc is less expensive than teaching it through a traditional lab.

An example may illustrate these findings. Suppose an institution has 200 students in its introductory biology course and wishes to offer them a lab experience in respiration. If the students are to work in pairs--the optimal procedure for this experiment--then the college must plan for 100 dyads each semester. For all students to complete a traditional lab, the college would need to schedule ten two-hour lab sections of twenty persons each, two persons per work station, at a cost of $769 per station, or $7690 per semester for all 200 students (line C, column 1 from previous table). To perform the complete respiration lab, as presented on videodisc, in a traditional lab would require two two-hour lab sessions per dyad, at a cost of $897 per station (line C, column 2 from previous table) for the two-session lab, or a total cost of $8970 per semester.

For the videodisc system, we assume two students can work on the disc for one hour and complete the experiment. With one videodisc station in continuous use (8 hours per day), 16 students per day can view the experiment. This will cost about $4025 (line C, column 3 from previous table) compared to $8970 for the traditional lab. Note however, that all 200 students can complete the traditional lab within 10 days; the videodisc scheduling requires 12-13 days. If two videodisc stations are used, all 200 students can complete the respiration experiment within 6 days at a cost of $8050 compared to $8970 for the traditional lab.

As this hypothetical example illustrates, videodisc instruction in respiration will be less expensive than the laboratory method.

POTENTIAL OF VIDEODISC

Interactive videodisc has been both revered and reviled in the literature. Two statements from (Thorkildsen and Friedman, 1984) summarize the polar positions:

> Interactive video is a breakthrough in instructional technology of potentially revolutionary import to educators (Levin, 1983, cited in Thorkildsen and Friedman, 1984);
>
> The complexity of the programming and the cost of learning situations virtually ensure that the videodisc cannot have a major impact on routine instructional practice (Hiscox, 1982, cited in Thorkildsen and Friedman, 1984).

It is too early determine which is the correct view. Only with continued support and development of interactive videodisc can its potential be assessed. This section describes the strengths and weaknesses of videodisc in general as a medium of instruction.

Advantages of Videodisc

Interactive videodisc has at least four technical advantages over other instructional media. First, videodisc has a large storage capacity. A two-sided disc holds about 100,000 individual frames. At a rate of one frame every ten seconds, a viewer would need close to 300 hours to view all the frames. Because of this large capacity, videodisc is a logical candidate to replace films or slides.

Second, a user can locate any specific frame within a second or two simply by typing a location code. In addition to such immediate random access, videodisc allows viewers to hold a frame (freeze or still frame) at length, so they can examine images or carefully review on-screen data.

Third, videodisc is more durable than other media. Discs won't wear out and are impervious to dirt, heat, and scratching.

Finally, the combination of videodisc and a computer provides a flexibility and individualization not possible with videotape, slides, or films. With an interactive videodisc, students can choose their own paths through the material and control their own rate of learning. The system can be programmed to analyze student responses and prepare diagnostic prescriptions. While a computer can provide some of these features, by using a videodisc and a computer in tandem viewers can see complex images, full-color pictures, and details that cannot be provided by traditional computer-based instruction.

Videodisc also has several pedagogical advantages. Because students have to make choices and respond to the program, they become actively involved in learning. Research literature shows that learning increases when students become active learners and receive feedback on their efforts (Wilson, 1981).

In addition, videodisc incorporates three modes for learning--written text, visual images, and sound--that work together to reinforce the major concepts or ideas. Because videodisc can match the pace and timing of presentation to a learner's requirements at a given moment, a wide range of students can be served by a single videodisc program. Students can be routed to appropriate remediation sections of the disc as necessary, and they can repeat and review sequences that they don't understand or wish to explore more carefully. Finally, videodisc encourages independent learning — a larger goal of the educational process.

When asked what they especially liked about the new medium, students and instructors who viewed the videodiscs for this evaluation were quick to mention the opportunity for self-pacing and user control. They also valued the immediate feedback and the consistency of presentation: an experiment is presented the same way without error, each time. Freedom from the chores of setting up equipment, cleaning up after the experiment, or redoing procedures because of errors were also mentioned.

Faculty members also cited the potential of interactive videodisc in promoting logical thinking and problem solving. Working interactively, students can sharpen their thought processes and develop critical thinking skills.

Several users commented on the affective impact of videodisc as a powerful motivator. Students working on videodisc are in control of their learning. They seem willing to take risks they might not in a traditional laboratory. Many students appreciated the fact that no one saw their errors and that they could quickly correct their mistakes. Many enjoyed a new sense of accomplishment, and many praised videodisc as a more efficient use of their time.

Videodisc seems especially appropriate for simulating experiments that cannot be peformed in a traditional lab. For example, high costs, scheduling restraints, and space limitations often preclude students in science courses for nonmajors, from conducting laboratory experiments. Videodiscs can give such students some exposure to laboratory work. Similarly, videodiscs can be used to simulate experiments in locations where lab facilities are not readily available, such as rural sites.

Disadvantages of Videodisc

Despite these advantages, there are distinct limitations to this new technology. First, the cost of videodisc limits its widespread use and acceptance.

Second, some technical problems persist: glitches in complex programs, the poor quality of the image resolution for fine details, and malfunctioning equipment, for example. The scarcity of good discs, the rapidity of technological change, and a lack of standardization (diskettes are only compatible with certain types of microcomputers), also work against videodisc as a common instructional tool.

Third, some researchers worry that videodisc instruction isolates learners and decreases the type of peer interaction that is conducive to learning. This objection, however, might be addressed by designing videodisc programs for two or more learners instead of for individuals, as is current practice. Other researchers question whether videodisc creates student dependency on the reinforcement provided by a computer (Arons, 1984). Finally, there is a limit to what kinds of subjects and skills can be taught by videodisc. Although faculty members are not yet sure of the best way to use interactive videodiscs in their curricula, the arts and literature seem less promising as areas of videodisc instruction.

This evaluation investigated whether intrinsic limitations of videodisc technology might be considered problems by users. After viewing a videodisc, students were asked whether they found it difficult to concentrate on the course material because of the hardware (microcomputer, videodisc player, or monitor). Their mean responses are shown below, where 1 = strongly disagree and 5 = strongly agree:

I found it difficult to concentrate on the material because of the hardware:

Respiration	2.0
Climate & Life	2.0
Titration	1.9
Chemical Decision Making	2.0
Motion	2.1
Energy	2.0

Students did not, apparently, find the hardware intrusive.

Students were also asked if they had any problems using the microcomputer, videodisc player, or monitor. Their mean responses are shown below, where 1 = no problems and 5 = many problems:

Did you have any problems:

	Respiration	C&L	Titration	Chem. Dec.	Motion	Energy
Inserting the videodisc or computer diskette?	1.2	1.4	1.4	1.1	1.1	1.2
Operating the videodisc player?	1.3	1.3	1.8	1.4	1.8	1.7
Using the keyboard?	1.2	1.1	1.4	1.1	1.3	1.2
With the reliability of the equipment?	1.5	1.6	2.1	1.2	2.7	1.8

For the most part the hardware worked satisfactorily, although students using the stopcock for the Titration experiment reported some difficulties with the reliability of the equipment, and at one of the physics sites the equipment caused temporary problems. However, given the movement of the equipment from site to site, it performed very satisfactorily.

Finally, students in both the videodisc and traditional lab conditions were asked whether anything occurred that interfered with their carrying out the experiment. The percentage of all students at all sites who responded 'yes' is shown below.

	Videodisc	Traditional Lab
Respiration	17%	8%
Climate & Life	26%	13%
Titration	39%	22%
Chemical Decision Making	24%	
Motion	66%	
Energy	44%	

Most problems encountered by the videodisc users related to the software—the programming on the disk—although some students reported difficulties with the hardware. For example, some viewers of the Respiration disc felt that their not being given the correct answer after three tries interfered with their learning, and many physics students felt that being unable to progress through the program until they had produced exactly the right answers prevented them from completing the lesson. Appendix A, critiques of each disc, describe in detail the problems students encountered.

When staff were asked to identify the major obstacles to videodisc in higher education, they listed faculty inertia and resistance to innovation, the expense of videodisc instruction, and the lack of quality programs at appropriate levels.

Summary

Users can articulate the advantages and potential of videodisc. If the technology improves and costs decrease, and if high-quality discs are developed, interactive videodisc could have a future in higher education. On the whole videodisc seems especially appropriate for teaching science, math, and technical subjects. Continued exploration of its uses and impact is encouraged.

RECOMMENDATIONS

For Videodisc Developers

Appendix A gives specific suggestions for improving each videodisc. The developers should read these suggestions carefully as some of the problems limit the usefulness of the discs.

The discs that simulate traditional laboratory experiences were not judged by faculty at research universities to be effective substitutes for a hands-on lab. But if the programming were revised to address the problems identified in Appendix A, these faculty would consider using videodiscs to supplement their curricula. Specifically, Respiration and Titration could be used before students conduct the traditional lab or to reinforce concepts afterward. However, some users felt that the Titration disc, as it stands, does not explain the process clearly enough for students unfamiliar with the topic. Chemical Decision Making seems most appropriate after students have conducted the qualitative analysis laboratory. Users at smaller colleges and institutions are more amenable to using these discs as substitutes. Climate and Life, Motion, and Energy cover topics not traditionally taught in a lab and can supplement students' coursework.

From the field testing data and findings of other researchers (for example Hoekema, 1983), we identified twelve guidelines for designing an educational videodisc. Although these guidelines are here presented as directives to designers, other groups (funding agencies, institutional users, and videodisc evaluators) can easily adapt them for their specific needs.

1. Build on features known to be effective from other instructional methods. The literature on the comparative effectiveness of different media, including computers, reveals that no one particular method produces significantly more impressive learning (Clark, 1983; Knapper, 1980). However, some research (Sherman and Ruskin, 1978) suggests that certain features and techniques for presenting material are more likely to promote learning. These features, based on research from the Personalized System of Instruction, include:

- Requiring a high level of mastery from students before they can proceed to a new unit in the program. Students should have to demonstrate an adequate understanding of the material, by passing a test, before they can undertake a new unit.
- Providing immediate feedback on performance so students know how they are doing and can determine which topics they do and do not understand.
- Offering review units or review questions to help students synthesize important concepts.

Thus a well-designed videodisc will include mastery tests, feedback, and review units.

2. Capitalize on the strengths of the medium. To exploit this visual medium, designers should limit the amount of text on the screen. Passive page-turning, when students

need only hit the return key to advance through the program, should also be avoided. The visuals should be of high quality, since users tend to apply the standards of broadcast television to videodiscs because the images appear on a television screen.

3. Use feedback messages to reinforce performance. One of the advantages of an interactive system is that it can acknowledge correct and incorrect answers. This feature can be used to provide consistent reinforcement for correct answers. Instead of responding, "Yes, you are correct," the computer can be programmed to print, "Yes, deserts have the smallest amount of rainfall."

4. Make the structure of the disc known. The organization or structure of an interactive videodisc program is not immediately evident. As Negroponte of MIT commented (cited in Hoekema, 1983), a book provides readers with simple tactile evidence of how far along they are in the text: we just compare how many pages we hold in our left hand with how many remain in our right hand. Videodiscs offer no such cues. Also, the many possibilities for branching can overwhelm students, and some may become lost in the program. Designers should therefore provide a conceptual map that serves as a table of contents. Students could easily access this map on the screen at any time by pushing a particular key. Hoekema also suggests other cues that designers can provide, such as nested menu structures, numbered lessons, section titles with running heads and feet, and color coding.

5. Provide the maximum amount of user control. The main strength of an interactive system is its flexibility and user control. Students should be able to review portions of the disc, to freeze frame, to return easily to main menus or submenus, and most importantly, to stop whenever they want. Each of the discs field tested could be improved in this area. A good videodisc should have the following control options:

- An exit key that permits students to stop the program at any time
- A key to go forward one section
- A key to go back one section
- A key to begin a section again
- Options for stop sequence, freeze frames and slow motion
- Option for fast forward or fast rewind with picture review
- A key to browse through the program for an overall sense of its contents
- An operable backspace key to correct typing errors on the keyboard
- A key that returns the user to the main menu or submenu
- A key that immediately displays the program structure

The programmable function keys of most microcomputers could be used for these purposes.

6. Set a rapid pace. Sequences must earn viewers' interest (Hoekema, 1983). It is better to create a fast pace with options for repeating sections than to design a slow-paced program that some users will find interminable. Students are accustomed to the fast cuts and pace of television, where shots are typically held for less than ten seconds. In particular, the introduction should grab students' attention

and immediately involve them in the program. Lengthy explanatory information, dull lists of objectives, or plodding introductory material bore students and make them impatient.

7. Carefully develop test questions. The test questions should require students to apply what they have learned to new situations. If the material involves novel or technical vocabulary, short answer questions are preferable to multiple-choice questions. The physics disc shows an admirable attempt to use natural language to help students conceptualize the main ideas. All the discs could be improved by the inclusion of a larger test bank of questions that could be randomly generated to ensure that the students have mastered one unit before they proceed to the next. Videodisc programs should also provide explanations for incorrect answers so that students can learn from their mistakes. It is extremely frustrating for students who give an incorrect answer to be told their choice is wrong, receive some help, try the same question again, still select the wrong answer, and then be looped to a new question.

8. Make the videodisc and computer diskette self-sufficient. The disc should not include directions to "see the instructor" or "ask for assistance" because neither may be available. Similarly, students did not necessarily use the written material as the designers had hoped. At some sites, students immediately began the videodisc program without bothering to read written material first. The

videodisc and diskette should contain all information essential for students to operate the hardware and proceed through the lesson without outside help.

9. Place the material in the context of the curriculum. To be effective, the lesson must fit into the curriculum. Designers can provide an instructor's manual to specify learning objectives, alert teachers to important concepts, and recommend ways to use the lesson.

10. Create a videodisc with personality. Hoekema (1983) advises designers to allow their humor, wit, and style to emerge in the program. While designers run the risk of being obnoxious or too cute, they also have the opportunity to make the user's learning experience more than a sterile encounter with a machine.

11. Devote sufficient time to the computer programming. It is easy for disc designers to get caught up in the glamour of the images and leave less time for the computer programming. However, the programming makes the lesson work and is critical to the success of the lesson. Discs can flounder because of weak programming. No matter how attractive the visuals, the lesson is a failure if the programming is inadequate. Spend time planning the programming to make sure it can do what it should.

12. Plan a generous production schedule. Videodisc development and formative evaluation require careful planning, and designers should avoid the temptation to rush into production with a sloppy program that could discourages users.

Place as much material as is artistically and financially possible on the disc. Then, when formative evaluation results reveal the inevitable problems with the disc, unsatisfactory material can be suppressed by revising the computer programming. The reverse, however, is not possible. Material cannot be added to the disc without expensive remastering. In some cases, through the technology of interactive videotape or "check" discs, it is possible to pretest the videodisc before it is mastered. At the minimum, the script should be carefully reviewed by potential users (students), content experts, and experts in learning theory or educational design.

For Funding Agencies

When a new technology emerges, there is often a rush to promote its use regardless of problems, issues, or particular situations. Videodisc has some overly enthusiastic supporters who view it as a solution to our most pressing educational problems. But this new technology should be used only when its special capabilities can solve a specific problem for a reasonable cost. The question to ask is, What can this medium do that others cannot?

Researchers are beginning to report on the effectiveness of videodisc instruction (see among others, Bork, 1981-82; Kearsley, 1981; Kadesch, 1980-81; Hoekema, 1983). From a review of the literature and these evaluation data, a profile of best uses of interactive science videodisc is emerging.

Findings suggest that videodisc may be appropriate for simulating at least four types of scientific procedures:

Time-consuming investigations. Experiments that take hours in a lab can be accomplished in seconds on a videodisc. For example, in a traditional respiration lab, where temperature is modified to examine the effect on different organisms, students often have lengthy waits between each temperature change. In the videodisc version, students need wait only seconds for each temperature specification. In addition, videodisc laboratories eliminate set-up, clean up, equipment failures, and repair time. Data that might take months to accumulate can be gathered in minutes through an interactive videodisc program.

Hypothetical conditions. The most attractive feature of videodisc is its ability to simulate both real and hypothetical conditions. For example, videodiscs can show certain physical motions that are impossible in the real world. Similarly, hypothetical properties of materials can be explored because materials can be assigned qualities that exceed their real parameters. While a computer can also simulate, videodisc offers the added advantage of realistic images to reinforce learning.

Potentially dangerous procedures. A videodisc program can enable students to mix potentially explosive or toxic chemicals without hazard.

Investigations that require expensive materials or equipment. Some scientific equipment, for example, a linear accelerator, is too expensive to be used for instruction. An interactive videodisc can simulate the performance of such equipment. Of course, the videodisc hardware is costly, but it is not as expensive as sophisticated science equipment. Similarly, through videodisc, students can study materials that are too expensive to be used in lab (gold or platinum).

Arons (1984) summarizes four conditions that justify the use of simulations:

1) when the phenomena are not directly accessible at reasonable effort or cost;
2) when extensive statistical trials are involved;
3) when students need help preparing for a hands-on experiment;
4) when the phenomena have already been observed and the student requires drill and guidance in analyzing various cases, registering conceptual schemes, or making predictions.

Funding agencies can guide the development of videodisc by supporting those projects that seem to make the most appropriate use of the medium. In these science lab videodiscs, Chemical Decision Making took advantage of the medium to promote problem solving, and Respiration used the medium to give students experience with a greater number of organisms than is possible in a traditional laboratory.

Titration, however, was judged an inadequate substitute for the traditional lab. Videotape, slides, or films might have accomplished the same goals. Arons (1984) has argued against simulating a titration lab: "A student in introductory chemistry should turn his own stopcocks, monitor titrations by eye, and make his own proportional computations quite a few times before having the processes obscured by a computer monitoring an electronic device and rapidly delivering the end result." And while the visuals in Climate and Life were appealing, it is not clear that the videodisc presentation accomplished more than slides, films, or videotapes might have.

Motion and Energy, because they cover material not possible in a traditional laboratory, are an appropriate use of the medium.

In sum, funding agencies are encouraged to continue to support videodisc development. We are only on the threshold of this new technology. As designers gain experience with interactive videodisc, its form and impact may change. In just the three years since these science discs were planned and produced, new technological innovations allow persons who are not computer programmers to write programs for videodisc and allow modifications in programming to accommodate students at different levels.

For Evaluators

On the basis of this evaluation, we offer three recommendations for future evaluations of videodiscs:

- Much greater emphasis on formative evaluation. Videodisc evaluation should have a very strong formative component and be less concerned with summative assessment until the programming has been revised. Like any complex new product, a videodisc must undergo revision before it is released. Designs for evaluations of videodiscs should include at least four phases:

1. review of materials before mastering by instructors other than the developers;
2. review of a simulated disc or check disc by students to identify inevitable bugs and problems;
3. pilot testing of the mastered disc in two sites: developers' home institution and one other college or university;
4. field testing in two or three sites (other than those used in the pilot testing) as part of the regular curriculum; such testing could include comparative studies (disc vs. lab).

Evaluators of videodisc should work closely with developers as they prepare their material to assure that pedagogical principles are observed and that the disc is evaluated at each cycle. It is also recommended that the formative evaluator be located at the same institution as the project developers or nearby to increase collaboration and communication.

- Limited field testing. Because the data we collected showed few differences in the reactions of students or faculty across the different types of sites, we suspect that intensive field testing in fewer sites would probably have produced similar results more efficiently.

- Emphasis on the disc as a product. The evaluation must be able to distinguish users' attitudes toward videodisc as a medium from their assessment of a particular videodisc. Without this distinction evaluators cannot ascertain whether users are responding to the specific product or to the technology as a whole.

The guidelines and procedures developed for this evaluation should be useful for other videodisc evaluations, and evaluators are encouraged to build on this foundation.

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Appendix A:

SUGGESTIONS FOR IMPROVING CLIMATE AND LIFE

(Compiled from reports by Vicki Brazeale, Judy Hirabayashi, and Joanne Stein)

General Comments

1. Provide a global schematic of program structure and format and the conceptual framework of the lesson. This could be presented at the beginning of the program and also as a handout students could refer to during the lesson. Or perhaps a standard key could return users to the schematic any time during the program. One of the problems of the disc is that students can get lost in the program and not know where they are. In addition, many concepts are presented in isolation and their relationships may not be clear. For example, how sunlight on earth varies with the seasons is mentioned at the beginning of the lesson and never referred to again. The schematics might be displayed as follows:

Structure

Mid latitude biomes Biome concept map Extreme biomes Challenges

Intro Study Quiz

Grassland etc.

A similar schematic could be constructed for the major concepts. In this way, new concepts could be tied more closely to the major themes: how changing distribution of sunlight affects climate and how organisms that live in a particular climatic zone, a biome, are adapted to the environment in which they live.

2. Provide a key so that students can exit at any time. There was frustration among students we observed who wanted to quit but could not. This exit key could offer the following choices:
   - Exit the program
   - Go forward one section
   - Go backward one section
   - Begin the section again
   - Return to submenu
   - Return to main menu

   This flexibility, in conjunction with an overall view of program structure, would provide for much greater user control and enable students to move around in the program.

3. Is it possible to create a stop sequence key? Some

students wanted to stop a particular segment to examine it more closely. For example, in climatograms in midlatitude biomes, question 5 asks students about information that was originally presented quite rapidly on videodisc. In the biome concept map section, students would find it useful to be able to stop sequence after each blue highlighting segment. Is a freeze frame or slow motion option possible?

4. Because there are no provisions for backspacing if you hit the wrong key, students should be told in the handout or in the program what happens if they hit the wrong key by mistake.

5. Minimize the dependence of the lesson on outside help. Eliminate directions such as, "You seem to be having trouble ... see your instructor." At Berkeley and Wisconsin instructors may not be available. Some students found this statement intimidating; others felt that it was up to them to decide if they needed assistance. Minimize the dependence of the lesson on outside help. If this statement is on videodisc and cannot be modified, at least indicate to students that the program will resume in twenty seconds.

6. Most importantly, provide the correct answers. It is extremely frustrating for a student to try to select the correct answer and then be told that the choice is wrong -- and to see the instructor. Perhaps they could be given prompts or recycled through aspects of the lesson, but in any event, the right answer should be shown to them.

7. Provide more feedback to students about their performance. An interactive system can respond to and acknowledge correct and incorrect answers. But in this disc, there is very little positive reinforcement or explanation of why a particular answer is wrong.

8. Students were curious about the organisms on the screen, and one small change that could greatly enhance learning would be to place the names of plants and animals on the screen as a computer overlay. The common rather than technical names should probably be used.

9. Sometimes the print falls off the screen. For example, the S in summer in the seasons segment and the L in latitude in the biome concept map are off the screen.

10. The worksheets need more careful attention.

    a. The relationship between worksheet and disc is not specified. The program could say, "Take a moment to look through the worksheets; you will be using them as you proceed through the videodisc."

b. It would be helpful to have headings on the worksheets to let students know from what specific subsections the questions are derived.

c. Question 1: biogeography doesn't seem to be defined in the beginning of the lesson.

d. Question 5: names of a and b are reversed; a should be desert; b should be midlatitude grassland.

e. Question 6: names of biomes should be listed.

f. Pages 37-38 are reversed. Questions 8-12 and 16-19 relate to extreme biomes and Questions 13-15 relate to biome concept map.

g. Page 39 should include d, desert, rather than give it a full page by itself.

h. Question 19 should precede Question 18, and be renumbered.

i. The purpose of Figure D seems unclear. What does it relate to?

Specific Comments on the Program

Program Introduction

1. Second frame: The question, "Does the title of this lesson appear on the screen below?" causes confusion because the answer will always be yes. The question should be changed to: "Does the title of the lesson you want appear on the screen?"

2. "Are you studying this lesson alone or with others?" should come before the title sequence.

3. The sequence, "Here is your assignment" makes students feel that they have to answer the questions. Perhaps a better wording would be, "Here is what you will study" or, "Here is what you will learn." You may have to delete the heading on the videodisc frame, substitute a computer overlay, and then return to the videodisc listing.

4. After the terms biome, climate, etc. are defined, students are asked to take a quiz on the metric system. Since no quiz on the metric system is then presented, it might be better to suggest that students review the

metric system before proceeding, if they feel it is necessary.

5. In the climatograms, the minus signs on the temperature look like decimal points.

6. Throughout the lesson, opportunities for illustrating motion are ignored. For example, movement could greatly enhance the visuals in the section about the sun and the earth's rotation.

7. It might be helpful to include in parentheses the other names of the terms in this section so students can find more information in their textbooks, e.g., biome concept map is also known as a Holdridge Life Zone in the Jensen Biology text.

Mid Latitude Biomes

1. Why is there a sound-off option? Our observations indicated that no student ever used it.

2. The introductory segment begins with: "The amount of moisture is also...." The word also is not appropriate. Better wording would be: "Sunlight is not the only factor affecting.... The amount of precipitation is also...."

3. The next segment introduces new resources that will be available to the student. The list is hard to follow and redundant: the words climatogram, plants and animals are listed separately for each biome. One option would be to say: "You will be able to examine climatograms, plants and animals for the following biomes...." Another option would be to reformat the selections into a 3 x 4 table:

	Climatogram	Plants	Animals
Grassland			
Tundra			
Desert			
etc.			

4. In all the different biomes, it would have been an improvement to have included more plant and animal adaptations. The representative city might also be repeated to reinforce learning. Students seemed to really like these sequences. The climatograms should be carefully checked to verify a match between audio and visual. We noted several discrepancies. For example, in chapparal, the midsummer temperature seems to be 17 degrees C on the climatogram not 27 degrees C (audio).

5. Some mismatch between audio and visual occurs in this segment. For instance, in the grassland animal sequence, a fox is shown while the voice-over discusses grazing animals.

6. There are some problems with the air movement segment.

   a. Air movement maps are reversed. Students press "1" for upper air and in fact they get ground air movement.
   b. After choosing upper air, students are recycled to the main menu instead of back to the sub menu. Perhaps students could be given a choice: ground air or main menu.
   c. The audio for the ground air segment asks students to try to determine how terrain would affect air flow. This is quite difficult for students since they haven't been given concepts or examples to show them how to do this and the map is only briefly shown.
   d. Movement could have been effectively used to show the currents. It would be nice if students could stop these segments for closer examination.

7. Quizzes should include the correct answer. If students get the answer wrong, they cannot always return to the question. The only way to find out the correct answer is to select it. The only way to exit this section is to get the correct answers. All this is very frustrating.

8. The quiz questions need to be double checked for accuracy. Are the climatograms correct? In one instance a climatogram looks like the desert biome except for a dip in temperature during the summer months. Do these climatograms describe actual biomes? Also, there is a need to check the biome comparison questions, especially those about deciduous forest with chapparal, grassland with deciduous forest, and chapparal with desert.

Biome Concept Map

1. The concept map is given three different names throughout the program and the worksheet: concept map, biome concept map, and biogeographic concept map. Are there any meaningful differences in these terms? Can students find out more about these maps using these terms or do they need additional information (e.g., Holdridge Life Zones).

2. The audio quality is not consistent. It seems to be lower in the biome concept map sequence than in other segments.

3. The quiz in midlatitude biomes refers to midlatitude as being between 30 and 40 degrees; in this segment, midlatitude is given as being between 30 and 45 degrees.

4. It might be better, in the quiz, to show students the questions before they see the map. We noted that this segment had fewer questions than had quizzes in other segments.

Extreme Biomes

1. As in the introduction to the midlatitude section where resources are listed, there is considerable redundancy in the listing. A table format as described above could be an improvement.

2. The first sentence in the introduction says, "For each of the six biomes you should study...." It would be better to say: "...you will have the option of studying...." to reinforce the unique qualities of interactive videodisc.

3. There is an excellent opportunity here to relate climatic conditions in the extreme biomes back to the concept of how the axis of rotation of the earth (and therefore, sunlight) changes during the seasons.

4. Are the climatograms all accurate? Does the desert receive more precipitation than the tundra? In the climatograms, there is an inconsistent use of audio. For example, there is no sound for taiga but there is for tundra.

5. In the section on tropical deciduous forest, there seems to be a close-up of a writing pen in the animal sequence (second frame). What is it? In addition, the tropical deciduous forest plants has several sequences with colored frames.

6. Is it accurate to say that no animals live in the tropical desert? What about oases? Also the same motion sequence is shown for animals and plants.

7. There are some mismatches between audio and visual, e.g., for tundra animals a musk ox is pictured while the audio describes a lemming.

8. In the quiz, a double negative question has caused some confusion: ("For which two biomes is lack of water not a problem...?") Another question seems to be missing a word: "In which of the following ____ biomes is precipitation the primary factor in determining..." The number of biomes should be specified because students can't get all the correct answers. Finally, there is no description of how the grading is established or what it means.

Challenges

1. As currently worded, "challenges" do not seem to be particularly challenging. In Challenge 1, the first sentence states: "You will study the factor of terrain, particularly mountain terrain...." A better wording might be: "You will be able to examine how altitude affects the distribution of plants and animals. You will

also examine how the climate on different sides of a mountain will vary according to the direction of prevailing winds."

2. The challenges as posed seem to be unclear. What should students do exactly? It would help the students if the challenges were also described on the worksheets. The map needs some information or directions for students. It is hard to read. Which mountain ranges should be examined? What should students look for?

3. In Challenge 2, new terminology is presented that is not covered previously: coniferous forest. Is snow a biome?

4. Do instructors really have these answers? Perhaps they could be supplied as a handout or in the program.

Appendix A:

SUGGESTIONS FOR IMPROVING RESPIRATION

(Compiled from reports by Vicki Brazeale, Judy Hirabayashi, and Joanne Stein)

General Comments

1. Provide a global schematic of program structure and format at the beginning of the program and as a handout students could refer to during the lesson by means of a standard key that would recall users to the schematic at any time during the program.

2. Provide a key so that students can exit at any time. Students frequently wished to review parts of the disc and to be able to skip the trial run. This exit key, could offer the following:

   - Exit the program
   - Go forward one section
   - Go backward one section
   - Begin the section again

   This flexibility, in conjunction with an overall view of the program's structure, would provide for much greater user control and enable students to move around in the program.

3. Is it possible to create a stop sequence key? Some students wanted to examine more closely parts of the program such as the introduction, where definitions and answers to questions are given.

4. There are no provisions for backspacing. Students should be told in the handout or in the program what happens if they inadvertently hit a key.

5. Better explanations of some concepts are needed.
   - Students should be aware that respiration described in this lesson is cellular or internal respiration.
   - Explain why the apparatus for measuring the respiration rate of pea seedlings is different.
   - The purpose of the control manometer is never described. Students were confused about its use.

6. The worksheets need more careful attention.
   - Because students are not instructed in the use of the worksheets until they begin the experiment, it is difficult for them to answer questions 1 and 2.
   - It would be helpful to give students an example in the worksheet of a completed data table, with a description of how each measurement was taken or

arrived at. This would eliminate some confusion about taking and recording measurements.

- The current data table has no place for control data and column 4 is not labeled correctly. Students are told that the fourth column calls for "readings in mm," but the worksheet only says "readings." It should probably say "manometer readings in mm."
- Some of the questions could be better phrased, for example Questions #3, 4, and 5 could be made parallel and elaborated:
  Question 3: Complete the data table on page ___.
  Question 4: Graph your data on page ___.
  Question 6 should be labeled Challenge or Advanced Activities (the label being consistent with the disc.) It could be rephrased: "Please answer the following questions about your proposed experiment." Sub "a" should be rewritten to be parallel with the other items: "What factors will you study?"
- The data table does not match the videodisc and is difficult for students to use.
  - Students are given a chance to choose up to five temperatures but there is space only to record three.
  - Organism 01 is the same for each entry. Students get confused with the multiple lines underneath 01. The same criticism applies to temperature T1, T2, etc.
  - Minutes between readings is standard for all tests that a student might do and should be entered only once.
  - R3-R0 is not clear to students. This should be described in more detail on the worksheet or students should be able to review the sequence on disc.
  - Temperature is not recorded along the top as stated on disc.
- Students aren't told to look at the graph before completing their own. Some students try to do it without instructions. Also, better instructions on how to plot the graph are needed.

Specific Comments on the Program

Program Introduction

1. Second frame: The question, "Does the title of this lesson appear on the screen below?" causes confusion because the answer will always be yes. The question should be changed to: "Does the title of the lesson you want appear on the screen below?"

2. The term main menu may be unfamiliar to some students. Could this be defined in the program or in the worksheets, replaced with a more generally descriptive title of the program format, or simply deleted?

3. After the questions are answered, a drawing of the experimental equipment is shown and described. The drawing is rather faint and difficult to see, especially that of the manometer scale. The apparatus is not named. It is, however, extremely helpful to have this material presented as a stop sequence.

4. After the drawing is described, students are given the option to review the drawing or continue. It might also be appropriate to give students the option of reviewing the questions.

Trial Run

1. Equilibration time is not defined.

2. During the trial run, when the temperature in the respiration chamber is equilibrating, time is being displayed on the screen but is not labeled. Students eventually figure out what these numbers mean but it would be less confusing with a label. Also, it is not explained to students why readings begin at ten minutes.

3. In the trial run segment when students are shown the experimental and control manometer scales, it would be nice to simulate what it means to take a reading instead of just saying, "At this point you will take a reading." More explanation is needed about the difference between an experimental and a control manometer scale and what the latter measures. Our observations indicated that students were confused about its purpose. Is the control manometer an unnecessary detail? Also, students didn't understand why time continues to accrue even though the visual on the manometer is halted.

4. The computer text on screen says, "At this point you will take an initial reading." Our observations reveal that students record this information even though this is still part of the trial run and students were instructed not to record data in the trial run.

5. It is not clear when the trial run is completed. A computer overlay might tell students. Also, students should be able to review the trial run, or to review instructions for the data sheets before they begin their own experiment.

Experiment

1. The next segment of the program describes goals in terms of why. In fact, the experiment is rather a matter of how and the goals should reflect this. For example, Goal 4: "Tell why pea seedlings, frogs, and mice respond differently to a change in temperature with regard to respiration rate" could be restated as, "Compare the differences in respiration rates of pea seedlings, mice and frogs at various temperatures between 0 and 50 C."

2. The section on scientific procedures seems a bit long. It also needs some introduction. After the trial run, students expect the experiment. Perhaps an introduction could be added; "Before you begin your experiment, you will learn about the scientific methods and get a chance to relate these methods to your experiment." This could be added by computer text. This loop does represent good use of the computer (sending students into remediation or further explanation only if they need it). Also, the videodisc states that there are "four aspects of the scientific process" and begins with number two. Where is number one?

3. If students get the wrong answer three times, both a videodisc instruction and a computer overlay direct students to seek assistance. The computer overlay should be deleted.

4. Some of the wording of the descriptions of scientific procedures might have been improved. For instance, "Science processes are the means by which you reach your goal" is not really accurate. A better alternative: "Scientists normally follow a particular sequence of procedures in formulating and conducting an experiment or investigation. This sequence is often called the scientific method. The steps in the scientific method can be called scientific procedures."

5. The questions that follow the description of science processes could be introduced by: "Now you will be asked several questions that will help you relate these science processes to the experiment you will be conducting." The next set of questions needs an introduction. Students are asked to name the independent and dependent variables in the experiment without having been introduced to these concepts, which are explained only after students get the wrong answer. One of the questions that asks students to formulate the hypothesis of the experiment gives away the results. Is this intentional?

6. If students select a temperature outside the range, the program response is the same as if they had selected temperatures too close together. Also, it appears as if

students must press ENTER after temperatures are selected, but are given no directions on the screen.

7. The program instructions to note the temperature do not match what is on the data sheets. The worksheets should be revised.

8. The description of experimental control could be elaborated by using an example from the experiment at hand. This is a chance to review the function of the control manometer.

9. After this section on scientific procedures, students might be given the option to review the trial run again before they begin their own experiment.

10. When the experiment begins, students are asked to select the temperatures and organisms they wish to study. After their selection, students are again asked "What temperature do you want the organism exposed to?" Better: "To which of your experimental temperatures would like the organism to be exposed first?"

11. Students are given two minutes at the most for taking readings but not given a range or a maximum. Nor are they told to take readings at equal intervals throughout the experiment.

12. It would be helpful to review the method for taking a reading before students take their first reading. RO needs to be defined. Is RO taken at time TO? If so, students need to know this before they begin. Should students also record readings on the control manometer? What are the measurements on the manometers? It isn't clear which is mm and which is cm.

13. After students have completed all the experiments, they are referred back to their data table and the remaining columns are explained. These explanations would be clearer if examples were given, if they were presented in writing, or if a repeat sequence were possible. None of the students we observed was able to complete this step.

14. Students are also asked to correct for differences in air pressure by subtracting the control from the experimental reading. This is the first time in the program that the control has been mentioned. Also, because there is no place on the data sheet to record control readings, students probably don't have a record of them.

15. The questions asked of students are so simple that they can be answered without doing the graph or completing the table.

16. Students are told they get a B. There has been no previous indication that this is a graded assignment nor are the standards described.

17. Towards the end of the program, students are told to press the space bar if they want to continue. When they do, "Are you sure you want to quit?" appears on the screen. If students push the space bar or ENTER to continue, they are returned to the beginning of the program.

Advanced Activities

1. In the menu the term advanced activities is used, but in the body of the program the term changes to challenges. The major section heads should be consistent.

2. The introduction to this section, "If you want to get a grade above a B....", should probably be dropped as instructors incorporate the discs in their classes in different ways.

3. Opportunities for introducing new concepts relevant to respiration are missed. For example, the notions of cold-blooded and warm-blooded animals could be discussed in advanced activities, thus expanding students' knowledge about temperature regulation and respiration. Some people found the current advanced activities trivial.

4. As in Climate and Life, instructors may not have the answers to the challenges or be available to assist students.

5. For Challenge II, students are asked to select factors from Challenge I, but the Challenge I list is off-screen and not available.

Appendix A:

SUGGESTIONS FOR IMPROVING CHEMICAL DECISION MAKING

(Compiled from reports by Beverly Cabello and Steve Chin)

General Comments

1. Provide better user control. Students should have greater flexibility to move within the program. A standard key should permit students to exit at any time. Students should be given options to:

    - Quit
    - Go forward one section
    - Go backward one section
    - Begin the section again
    - Return to the main menu
    - Stop sequence
    - Review sequence in slow motion

2. There are no provisions for backspacing. Students should be told in the handout or in the program what happens if they hit a key by mistake.

3. Omit references to instructor assistance. In most of the test sites there is no instructor available. The program should stand alone.

4. Expand explanations and instructions. Some users did not know how to approach the experiment. They felt they had no basis for determining correct procedures. Students wanted more explanations of why things happened and how to get correct results.

5. The worksheets and guide for instructors could be modified:
    a. In the Instructor's Guide the description of the tasks doesn't match the order on the disc.
    b. In the Instructor's Guide mention is made of comparing results with those of the Key. No Key is included.
    c. On the student worksheet, 6-0 Reactions in Six-Solutions Problem, the species in solution are represented as if they were in molecular form, NaNO3. They are more accurately described as existing as separate ions: Na+(aq), NO3-(aq).
    d. In 6/1, the reaction information presented in paragraph form might be more usefully presented as a table to highlight the categories of information.
    e. In 6/3, the sentence, "When there is no difference in the results based upon order of addition...." is unclear.

f. In Q-0 Qualitative Analysis, a table of relative stabilities of the various products might be more useful than simply the chemical reactions by themselves.

g. In Q-1 Analysis of Cation Mixtures, the student is told to devise a scheme of analysis, but is not told how to. A series of questions that guide the student to the correct scheme might be helpful.

Specific Comments

First Time User Option

1. "Press the space bar to enter the key(s) you pressed." The meaning of ENTER is not clear, especially as there is a key marked ENTER on the keyboard.

2. The descriptions of the upcoming experiments could be labeled as such. For example, "The identities of several unlabeled solutions may be deduced from experiments where samples are mixed" could be identified as the Option B experiment involving six test tube unknowns. Likewise for the Option C experiment involving cation reactions.

Option A: Introduction

1. The computer-generated text used for the labels does not fit on the videodisc bottles and the ends of the chemical names extend uncomfortably into space.

2. Students are instructed to call for assistance if they get the labeling wrong. As mentioned, in many sites no instructor is available. This should be eliminated.

Option B: Six Solutions

1. "The reactions that take place are implied by the names used to label the solutions." Is this misleading? It seems to be a confusing method of classifying reactions.

2. " ..develop a systematic scheme for recording your experimental observations." It might be useful if the student were given a possible scheme at this point.

3. Nothing is mentioned here about the scoring aspects of the lesson and the introduction would seem a good place to do this.

4. It might also be helpful to put the warning in the Instructor's Guide about the importance of the monitor's

color adjustment here (e.g., in distinguishing white silver chloride from yellow silver bromide). If the color is not adjusted correctly, both appear white and can only be distinguished by examining the way in which the two compounds splash differently on the inside walls of the test tube. It would be easier to adjust the color if the student is given an "adjust color" option before beginning the experiment.

5. "After a sufficient number of observations are made, you must decide how the tubes should have been labeled." It might be helpful to tell the students what constitutes "a sufficient number" and how to "decide" identities.

6. "It's poor practice to waste chemicals repeating tests just because you take records that are incomplete." Some instructors felt that this was an inappropriate remark. They pointed out that repeated experiments are important for accurate lab work.

7. "You use up portions of solutions each time an experiment is performed." Unclear definition of portions.

8. In the evaluation of the student's results, the program erases the student's results and shows the correct results. It would be preferable if the student could make a direct comparison of his or her results with the correct ones. The instructional value of the lesson could be increased if the students were given even partial credit for their answers, or some analysis of their errors.

Option C: Cation Identification

1. At the end of the demonstration of proper laboratory manipulation techniques, the scientist says that tubes containing a precipitate will appear on the left of the screen and a tube containing the supernatant will appear on the right of the screen. This display does not appear until many screens later.

2. A close-up of the demonstrator showing the separation of the supernatant from the precipitate might make it better to see.

3. "Estimate the smallest number of tests you can make to see how they react...Since there are four cations and three reagents, there are 4 x 3 or 12 possible combinations." Is this accurate? You are allowed to mix each cation with up to three reagents in each test. The order of mixing affects the outcome so there are six combinations per cation or 4 x 6 = 24 possible combinations.

4. To select the reagents to mix with the cations, students are required to type in a number 1, 2, or 3 representing, respectively, the three reagents. It is difficult for the student to remember the identity of the reagent corresponding to the number. It would be helpful if the input for the reagents matched their names more closely, e.g., AM for ammonia.

5. When adding reagents to cations, the type of reagent or cation currently in the tube should be displayed alongside the picture. This would help the student take more accurate observations by clarifying the reaction taking place.

6. "You may now select any combination of cations and any sequence of reagents to study." In this section the student may choose to combine up to four cations and three reagents at once. The results is a possible 144 (4 x 3 x 2 x 1 x 3 x 2 x 1) combinations. Students have been implicitly taught in previous sections to examine exhaustively all possible combinations and at this point may be overwhelmed when presented with all the options. Hints for organizing data collection would be helpful.

7. Students are rewarded with +15 points if correct and -30 points if partially or totally incorrect. This seems very severe. Could the point system be revised? Is it possible to analyze student errors and give some explanation for wrong answers?

8. The quiz section should be better explained. Students are not told that a correct answer will be rewarded with an opportunity to answer additional questions (up to a maximum of three questions).

9. "Press letters of the reagent sequences that do work." What is meant by "do work?"

Appendix A:

SUGGESTIONS FOR IMPROVING TITRATION

(Compiled from reports by Beverly Cabello and Steve Chin)

This evaluation is limited because the paddle control for the titrations was not available at UC Berkeley. These comments are based on our review of only those parts of the videodisc that we could use at Berkeley and on reports from field test sites about problems.

General Comments

1. Provide more opportunities for movement within the program and better user control. A standard key should permit students to exit at any time. Students should be given options to:

   - Quit
   - Go forward one section
   - Go backward one section
   - Begin the section again
   - Return to main menu
   - Stop sequence
   - Review sequence in slow motion

2. There are no provisions for backspacing. Students should be told in the handout or in the program what happens if they hit a key by mistake.

3. Some concepts need better explanations. For example, key words such as WASH, RINSE, DISSOLVE need to be clearer to the student. The main points could be reinforced by superimposing computer-generated text on the appropriate sections of the video.

4. The worksheets could be modified:
   a. On Titration worksheet 2, provide more suggestions about appropriate observations and measurements to make free-form data collection more informative.
   b. Titration Practice Problems (Key): This is a good clear set of worked out solutions but not all students will use the technique (dimensional analysis) employed in the solution set to solve problems.

5. Some of the printed letters are hard to read.

6. On occasion, users had difficulty in making the machine operate, e.g., knowing what the paddle symbol on the

screen means, knowing how to "flip" back and forth through the disc. A brief manual or some on-screen instructions on operating the hardware would be helpful. Some students had trouble with the stopcock; the program got stuck on "Close stopcock before leaving" and would not advance.

Specific Comments

1. Equations are flashed too quickly. Students should have control over the duration of the presentation.

2. Minimize close-up shots of lab assistant's face. Students tended to focus on his face rather than on procedures.

3. At the frame, "What do you want to do?" students typed in STOP. The program would neither stop nor advance.

4. In the Techniques section, the illustrations of common mistakes should be kept as brief as possible. We observed students becoming frustrated when forced to watch the methodical lab assistant rinse the burette yet another time. Some faculty members who viewed this disc took exception to the disc's saying that one should not use a funnel in filling a burette.

5. Some students felt that the pauses between reading the meniscus and adding titrant made the experiment difficult.

6. In the Experiment section, the actual meaning of key words used to select what the student wants to do are unclear. A list of key words (such as that provided in the materials for the instructor) would be useful for the student in deciphering CLEAR or SELECT. A minor bug: before any other choices are made in the experimental setup section, if the student first chooses RINSE the computer responds, "Are you sure burette is already rinsed?"

7. The word parallax is spelled wrong.

8. It should be always be possible to see the flask while one is adding the titrant, particularly near the endpoint; when adding half-drops, one cannot see the flask.

9. There is an error in programming: the student is told that there is no reagent left even though 800 ml are left.

10. When a mistake is made in the calculation of molarity, students are not able to find a means to correct it.

11. Students had difficulty with the TARE operation. Many found it confusing. It would be better if the taring of the sample container were done in such a way that positive mass is recorded.

12. Does the burette drain dry without the student's being told that the process is occurring?

Appendix A:

SUGGESTIONS FOR IMPROVING STUDIES IN MOTION

(compiled from reports by Larry Braskamp, Tim Erickson, and Ann Smith)

General Comments

1. Provide a global schematic of program structure and format. This could be presented at the beginning of the program and as a handout students could refer to during the lesson. Or a standard key could recall the schematic at any time during the program. An overview of the entire disc would save the students from getting "lost" in the program.

2. Increase user control. Students should be able to exit at any time. The difficulty in finding a flying gymnast's center of mass is made intolerable by the inability to move on. Make the program more flexible by providing keys that let students:

    - Quit
    - Go forward one section
    - Go backward one section
    - Begin the section again
    - Freeze frame or stop action
    - Page through the program

3. Check the re-entry system. Frequently students were unable to return to their lesson after signing off the computer. Entry of any lesson number resulted in the entire program's beginning again.

4. Improve the branching. Progress through the program is quite linear and does not capitalize on the medium. This material uses small loops ("do you want to see it again?") but offers no real chances for investigation or choice. Students could be given a choice of which diver or gymnast to see first. This could be done without completely giving up instructional prerequisites. For example, learning where the center of mass is does not require an understanding of acceleration.

5. The use of "natural-language" is an admirable effort. However, some correct answers are rejected as wrong which is frustrating to the user. Some students were uncertain which words to type, e.g., equal or same. The "dictionary" is a help, but this still caused problems.

6. Students need consistent reinforcement for right answers and automatic help or correction if they get too many wrong. Positive reinforcement was inconsistent and too

often students could not get the correct answer and became trapped at a data table doing calculations.

7. Give better instructions or explanations. Concepts such as acceleration and velocity are not defined in the program. Include a computer-generated frame or two at the appropriate places describing the basic concepts and formulas. Sometimes they are described only after the student gets the right answer. For example, remind students that acceleration is twice the mean velocity divided by time. Remind students that they need to have a calculator or a protractor available.

8. Be less finicky about accepting answers! Users complained bitterly about the difficulty of pinpointing the center of mass with the cursor. At one site students were timed spending thirty minutes on this task! Students were within a few tenths of a millimeter and wasted their time finding the exact location. If a student tries three or four times, he/she should be shown the correct location with a simple explanation. Allow more flexibilty, as when students find the diver's feet. Consider increasing the error tolerance not only on center of mass but also in accepting calculations so that, for example, 4.7 is as satisfactory answer as 4.759.

9. Consider providing students with a trouble-shooting guide to go with the videodisc so users know how to solve common dilemmas (such as center of mass, the bar, end of the red line).

10. Users reported difficulty with the system. In some cases it malfunctioned and students were unable to complete the program. Problems included System IO errors, at which point the phrase "System IO Error #1 P+164 I #102" kept appearing on the screen. In another instance, the lesson stopped at FF5 and wouldn't advance.

Specific Comments

Introduction

1. At the start of the videodisc, the question "Is this the lesson you wanted?" is appropriate but later, "Does the title of this lesson appear on the screen?" is unnecessary.

2. In the welcome and directions section, horizontal lines through the colored words make them blurred.

3. As mentioned, this segment could benefit from an overall view or general "road map" of the videodisc.

Jan the Dancer

1. Jan is fine but the camera is very static. For an opening sequence this is boring for many students. Some students, realizing that they would have to see it again, left. This initial sequence could be abbreviated to retain student interest.

2. The freeze after the second change is on a jiggle frame.

Free Fall

1. "...analyze falls and jumps to see why one of Jan's jumps didn't look right...." At this point the student doesn't know that the presentation is built conceptually around falling, jumping, and spinning. Let students in on what is going on.

2. When Wendy is falling, students are supposed to put the arrow where she'll go the fastest. When students see her, they are only asked to tell if they were right. If wrong, they try again. The problem is that if you never drive down far enough, you never see where the "top of pool" marker is, so you may think your marker is on the top of the pool, which, in projection, it is. Confusion might be averted by stopping Wendy when she gets to the arrow if the arrow is in the wrong place.

3. When the sequence on Wendy's fall comes, the directions state that the data need to be recorded in a notebook. It is hard to read the data on the screen because zeros look like eights. If a student writes down the wrong number, the calculations are all wrong.

4. A glitch at one site only: After Wendy's falling sequence, when #2 was pushed to continue the lesson, the disc would go back to the beginning of Wendy's diving sequence instead of continuing.

5. In this sequence, the natural language fails. A user types. "Wendy speeds up as she falls" and gets "Sorry! Wendy's speed increases linearly with time." Students may not have enough information at this point to tell that her speed increases linearly.

6. Sometimes an answer was entered and there was no immediate feedback to know if the answer was correct. If the program continued, students assumed they were right, but it would be nice to provide the feedback.

7. At the end of Wendy's sequence, students are asked to predict the distance she will travel in .80 seconds. Typing in a 3 leads immediately to the banner for Dave's diving sequence. Only afterwards do students see that they can check if they are right. It might be helpful to

let students know what is going on.

8. After seeing Dave's diving sequence, students test their prediction. Their prediction is shown, but it would be nice to add the "for what" i.e., for .8 seconds.

9. Check numbers on screen. "... 3 x .26 = 8" doesn't track.

10. Only 9.8 m/s/s is accepted as the acceleration of gravity. 9.81 doesn't seem to be accepted. Check numbers in the table, the calculations give results like 9.4 (that's 1.88 meters per second in .40 seconds).

11. The prediction sequence— "put the arrow where Dave will be after 0.6 seconds"— is great, but the vertical bar should be closer to the center of the screen. The background lane lines are not parallel to the screen bottom and may lead to mistakes in lining the arrow up with the distant tick-mark.

Up and Down Motion

1. The jump at the top is not just like a fall, because of the forward velocity we're about to study.

2. The phrase "once Dave leaves the board" comes too late. Before students have read the caveat, they've seen him take off and land a couple times and been asked if his acceleration is constant.

3. There are no instructions in the handout on how to measure the height required.

Projectile Motion

1. There is no reinforcement for a right answer when students choose Jan's second leap as the altered one.

2. When the right answer is "center of mass," that answer doesn't fit on the line.

3. There are problems on starting to mark Martha's center of mass. When one student was viewing it, Martha was just starting her vault and the directions said "Use the arrow keys to move the + to Martha's new position." It wasn't clear that the center of mass was to be marked or whether the new position was the one on the screen or a prediction of where she'd be next. It turned out to be the one on the screen. The picture and directions do not appear to be synchronized. It was very frustrating for the student who spent more than twenty minutes trying to mark it.

4. What students finally see as the center of mass of the gymnasts is sometimes not their center of mass. Students are told to follow one point on the gymnast's body. That seems wrong. Students are finally told that the center of mass changes, but only after they've tried a couple of these hellish exercises and gone on to the divers. When students track Martha's jump, the center of mass one accepts is on roughly the same part of her body even though she flexes quite a bit.

5. Sentence change: "...two motions—vertical acceleration and horizontal constant speed." Not parallel construction. Maybe "..with speed changing in the vertical direction and unchanging in the horizontal..."

6. Students are asked to describe how Martha's velocity changes as she goes upwards and then downwards. If students answers, "decreases" both times, something shows up on the screen for an instant, and is then replaced by the message that the second answer is wrong.

7. As students finish PM4: "...an independent ... motion is added to it." It should be mentioned that this independent motion is the horizontal motion studied earlier.

8. The projectile motion portion needs a grid for the TV screen. Each lab group made one, but it took too much time.

9. No feedback on the "were you right?" question.

10. The graph of Martha running doesn't seem traditionally drawn. Why couldn't Martha run from left to right?

Rotational Motion

1. The handout has straight leg data before bent leg data and the videodisc is just the opposite. Change the handout.

2. There should be a protractor available to measure Jim's angle of rotation.

3. In this section, the computer didn't accept some words: angular momentum, speed, conservation of angular momentum.

4. One of the first questions: "...how does his rotational speed change...?" has a missing first character on the answer.

5. Problems in trying to place the + on the bar. What's happening?

6. Problem in placing the + on the end of the red line. What red line?

7. Provide feedback when students choose a moment of inertia correctly.

8. Check the angle measurements. Some users report the measurements were as much as 7 degrees off.

Summary Section

1. Terrific section. Students can relate what they've learned about the physics of motion. Perhaps these sequences should be shown earlier, even if the words are unfamiliar.

Appendix A:

SUGGESTIONS FOR IMPROVING ENERGY TRANSFORMATION

(Compiled from reports by Larry Braskamp, Tim Erickson, and Denise Kiser)

General Comments

1. This disc and its accompanying software are an improvement over Studies in Motion. Many of the general and specific problems noted previously have been corrected. The following aspects are especially noteworthy:

   a. Individual sequences are shorter, and the user has greater choice of instructional sequence.

   b. Inexact numerical values are preserved; we see our answers validated and compared with "our instructor's" values.

   c. Fewer attempts are made at natural language processing.

   d. There is more explanation on the screen; the help section on work and the work-energy theorem, for example, is very useful.

   e. In the experimental sections, we get a wide choice of set-ups. We get to choose cyclists and equipment— almost always.

   But some problems persist and the suggestions that follow are intended to improve this videodisc lesson.

2. Increase user control. Students should be able to exit at any time. The difficulty of finding the hub of the bicycle is made agonizing by the inability to move on. Make the program more flexible by providing keys that let students:

   - Quit
   - Go forward one section
   - Go backward one section
   - Begin the section again
   - Freeze frame or stop action

   The SCAN commands to page through the program are very helpful and work well, except in assigning weights.

3. Improve the branching. Progress through the program is quite linear, with looping used to repeat sections. The disc seems to be designed like a textbook— proceeding from one chapter to the next (even the heading, "Chapter" suggests written material). Users simply refer to the "contents" (menu) for the chapter they desire. The lesson has not capitalized on the medium's potential to diagnose errors and branch to appropriate lessons.

4. Provide systematic feedback. Students need consistent reinforcement for right answers and automatic help or correction if they get too many wrong. Positive reinforcement was inconsistent and too often students could not get the correct answer and became trapped in the program. In addition, the student's name is requested but never used.

5. Consider revising chapter numbering. The numbering sequence is not clear and seems awkward. Also, chapter length is inconsistent. Some of the data gathering sections are quite lengthy and cannot be exited without having to start all over again at the next session. Some sections consist of only one frame. In addition, choosing options at stop points seems to result in inconsistent branching. If we choose to continue, sometimes we proceed, sometimes we are given the "local" menu, and other times the main menu is thrust upon us.

6. Give better instructions and explanations. Some students seem confused about concepts: is energy input the same as work required? Students also wanted more information on solving for AMA, instructions on calculating IMA, definition of rolling resistance, explanations of the importance of AMA and IMA, and discussion on finding centroids. Also, it would be useful to remind students that they need to have a calculator available.

7. Be less finicky about accepting answers! Users complained about the difficulty of pinpointing the hub of the bicycle (in fact it seems to be slightly to the right), determining the exact stop point, etc. We finally got the cursor location to work by pretending that its "hot spot" was at the end of the left arm instead of in the middle. This could be software, our misperception, or trouble with the overlay in the horizontal direction. Allow more flexibility. Some users commented that the computer was erratic in accepting answers, sometimes it accepted ranges or responses that were slightly off, while other times it did not.

8. Explain some of the overlays. The bright lines, computer-generated, that appear when the pedal crank has gone all the way around are mystifying. When they first came up, we couldn't tell what they were for because they did not line up very well with the pedals on the screen.

9. The idea of using a bicycle is terrific, but the lab needs to be more investigative, with more mystery and less cookbook; less cut-and-dried, and more scientific. Suppose we have an actual mechanical advantage sequence with the gear number covered up. Then we would have to figure out the gear number from our other data. This could be more exciting and something a computer can do that isn't easy to arrange in the lab.

Specific Comments

Chapter 10: Introduction

1. Instructions for the first time user are given clearly and concisely. The slides are appropriate and nicely done; use of computer overlay is a good idea.

2. A few short questions (perhaps multiple choice), evaluation and immediate feedback at the end of this section would help students decide whether to see this section again.

3. The chain "Food—Input—Transmission—Loss—Output" could be emphasized more.

4. Choosing Option 1 at the stop point repeats the entire section. Why not indicate this? "Review" seems to connote a condensation or summary of material already presented.

Chapter 20: Energy Input

1. Choosing Chapter 20 from the main menu leads to a submenu that includes Chapter 20. Choosing Chapter 20 from this submenu leads to the Chapter 20 title frame, with instructions to press the space bar. On pressing the space bar, the submenu appears again. Until users realize that Chapter 20 consists of only one title frame, they might feel something has been missed.

Chapter 21: Introduction

1. A good attention grabbing introduction is mitigated by viewing the same submenu again. Can students move directly to the lesson?

Chapter 22: Energy Input Calculations

1. Formulas are clearly displayed.

2. Would it be possible to provide an analysis of students' errors? For example, instead of instructing students to return to the text or see the teacher if they cannot answer the question correctly, why not give students a second question broken into smaller steps so they can pinpoint exactly the source of their problems. There are missed opportunities for individualized remediation. The computer merely demonstrates extreme patience by informing students that their answer is wrong, over and over.

3. The help section is useful but the question on "making one operation" is frustrating. It is not clear exactly what is being asked for. Consider listing the words at the bottom of the screen (with the question), or indicate at the start that a list of words will be provided. It is also impossible to get out of this question without aborting the lesson.

4. Similarly, for the question about the coordinate system, the user does not know if one word would be appropriate or a sentence is necessary. The list is provided after the choice is made.

5. When the coordinate system is defined, positive-x is opposite traditional coordinate systems and subsequent force vectors are positive to the right. Why the inconsistency or are we misreading it?

6. When we say the integration variables are x and y instead of phi, we get no feedback.

7. When we make the sample energy calculation from 30 to 60 degrees, we get no feedback. In addition, the length of the pedal should be present on the screen in the earlier frames.

8. Data are plural not singular ("was" should be "were").

Chapter 23: 12-speed Sport—Heidi

1. Nice use of video with the changing force vectors.

2. Selecting review Option 1 takes the user back to the menu. This might be a good spot for individualization and branching.

Chapters 24, 25 and 26

1. There are no spaces provided in the student manual for calculations for these chapters. Provide guidance to students on where these answers should be recorded.

2. Good experiment, though, more sophisticated than anything that follows.

Chapter 30

1. The menu format is good. Chapters 33 and 37 are listed in the manual's Contents but not on this menu.

Chapter 34

1. Good use of using interactive video for data gathering. The student chooses the beginning and end points of the run, with some possibility of error, making this realistic.

2. At first it's not obvious what the flashing line is for, but this experiment makes good use of the cursor.

Chapter 35: Gear Ratios

1. Are Options 1 and 3 basically the same?

Chapters 36 and 37: Actual Mechanical Advantage

1. Choosing Chapter 36 leads to an introductory sentence, a title, a definition, and back to the menu. Chapter 37 does not seem accessible from the menu.

2. Some students reported that they tried torque equations to calculate AMA only to learn that they were supposed to guess. Instructions should indicate this.

3. In the Gear Ratios section, menu items 2 and 3 are reversed for the 3-speed bike.

Chapter 38: Force Ratios

1. In a traditional lab, students are aware of the equipment available before doing an experiment. Why not list the available weights and make this list accessible (by entering a key) during the course of the experiment?

2. It is motivating to see the immediate effects of one's answers. However, if users get the wrong answer, there is no help, source of error diagnosis or remediation. This may turn into merely a guessing game for some students.

3. Users cannot quit this section without aborting the lesson and having to repeat it from the beginning the next time. Some users felt that this experiment could be conducted with more flexibility in a traditional lab.

Chapters 40 and 41: Energy Losses

1. The program accepts 20 cm as a proper height but using this number in the formula gives 13.95 N as the answer which is subsequently not accepted by the computer.

Chapter 42: Rolling Resistance

1. In calculating rolling resistance, some students had difficulties knowing what to do with the cursor.

2. Some students spent over an hour on an incorrect prompt for grass rolling resistance.

3. There's a problem with natural language. When asked how to calculate resisting force, we type "divide the energy by the distance" and are told we are wrong.

Chapter 43: Masses and Centers of Masses

1. Users reported frustrations in completing this chapter, particularly in placing the cursor on the rear hub and determining when the bicycle stops and feet touch ground. The computer is limited in the areas it will accept and monitor resolution does not make this section easy.

2. In a traditional laboratory, students would either take measurements with varying degrees of accuracy, or device detectors to use in the experiment. In this videodisc, precision seems to be more a question of eye-hand coordination.

3. Why is this section called "Center of Mass?" There are no center of mass calculations; the section seems to be about rolling friction.

4. A possible glitch: when first asked to hit <e> when the bicycle stopped, we got the "oops" message, "try again." Then, the lesson asked us to hit <e> when her foot touches the ground (not the bicycle). Is there a difference here?

5. The message should read, "when her foot FIRST touches the ground." Some users had trouble, waiting for the heel to fall.

6. Choice 2 at the stop point leads to Chapter 40. Pressing the space bar leads to the Chapter 41 Introduction again. Is it necessary to see the Introduction again in order to proceed from Chapter 43 to Chapter 44 or 45?

Chapter 45: Wind Tunnel Experiments

1. Good section using the medium to advantage.

2. One instructor felt that using "knots" was inappropriate.

3. Is it possible to show the dial not just the numbers on screen?

Chapter 50: Braking

1. Is there audio for this section?

Chapter 60: Energy Output

1. Chapters 63-66 are left out of the menu, while Chapter 67 has been left out of the Table of Contents in the manual. If space is a consideration, why not omit Chapters 10-50? Is it not possible to access Chapters 63-66 from this menu?

2. Users cannot exit this sequence of experiments without aborting the program and beginning over again. This is a long section and consideration should be given to exit points.

3. Users should be able to choose which gear to use and the stop time of the data taking by hitting a key.

4. Another problem is that the translational kinetic energy of the cyclist plus cycle is zero in this demonstration. They're moving on rollers— we're neglecting rotational kinetic energy— and that's all we see.

5. What's the point of showing us different gears. All we really see is the difference in mechanical advantage. What guarantee do we have that the same work is being put into overcoming the rotational friction of the rollers? If it were, the cycle would travel at the same speed regardless of gear.

Chapter 62

1. Choosing "quit" at the stop point and then reentering the program loops you to Chapter 60 (the Introduction). Is it necessary to see the Intro again?

2. This Chapter is impossible to complete unless all the correct answers are given.

Student Manual

1. Students noted several problems:
    a. On page 7, the calculations give a force of 13.7N but the computer will only accept 14N;
    b. On page 8, the necessary calculations require more than the specified five data points (situations);
    c. On page 10, without assuming that energy input is the same for every gear (and equal to energy calculated on page 4), the table would not be complete;
    d. Questions on pages 12-14 are confusing.

2 of 2

SCIENCE LAB VIDEODISCS

Appendix B: Questionnaire Results

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July, 1984

APPENDIX B

I. Questionnaire Results Across Sites

Climate and Life 1
Respiration 12
Titration 23
Chemical Decision Making 34
Motion 42
Energy 50

II. Open Ended Comments

Climate and Life 58
Respiration 65
Titration 72
Chemical Decision Making 78
Motion 82
Energy 85

III. Questionnaire Results By Site

Climate and Life

UC Berkeley 89
University of Nebraska, Lincoln 93
Emporia State University 101

Respiration

UC Berkeley 108
University of Nebraska, Lincoln 119
Emporia State University 130

Titration

University of Wisconsin, Madison 141
University of Nebraska, Lincoln 148
UCLA 152

Chemical Decision Making

University of Wisconsin, Madison 159
University of Nebraska, Lincoln 163
UCLA 167

Motion

Illinois Central College 171
Kansas State University 175

Energy

Illinois Central College 179
University of Nebraska, Lincoln 183

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ____________ Course: ____________ Climate & Life (N ≃ 95)

Date: ____________

3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
✓ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

'4) 1. What is the general area of your major?

19% (1) undeclared
3% (2) engineering
9% (3) physical sciences
29% (4) biological sciences
10% (5) social sciences
3% (6) humanities
28% (7) other (describe): ____________

'5) 2. What is your approximate grade point average (GPA) at this school?

19% (1) 3.5-4.0
28% (2) 3.0-3.4
15% (3) 2.5-2.9
2% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
36% (7) no GPA yet

(6) 3. What is your gender?

35% (1) male
65% (2) female

(7) 4. Is English your first language?

91% (1) yes
(8) 9% (2) no (what is your first language? ____________)

5. Prior to this videodisc how would you rate your skills in

$\bar{X}$			Not at all skilled				Very skilled
(9)	1.9	a. using microcomputers?	1	2	3	4	5
	2.0	b. using videodisc players?	1	2	3	4	5
(11)	3.1	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 58%	2 38%	3 4%
	b. perform or view another lab experiment on this same topic?	1 88%	2 11%	3 1%
(14)	c. perform this lab before?	1 98%	2 1%	3 1%

(15) 7. How many separate sessions did you view this videodisc?

83% (1) one
16% (2) two
1% (3) three or more (How many? ________)

8. In minutes, approximately how much time did you spend

range
(0-180)

a. in preparation before you actually began working on the videodisc lab? x̄=17

6-18) b. actually working on the videodisc? x̄=100 (range 0-225)

19-21) c. outside of lab writing up a report? x̄=17 (range 0-90)

2-24)

25) 9. The amount of time you were allowed for viewing this disc was

5% (1) too much (more than necessary)
19% (2) too little (How much more time was needed? ____________________)
76% (3) about right

6) 10. For this lab videodisc, did you work

65% (1) alone
13% (2) with one other person
7% (3) with two other people
11% (4) with more than two people

27) 11. Was it required that you view this videodisc?

81% (1) yes
19% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	x̄		Not an important reason				A very important reason
			1	2	3	4	5
(28)	3.4	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	2.1	b. because another student recommended it	1	2	3	4	5
	1.9	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	3.0	d. to learn more about the subject matter	1	2		4	5
	2.2	e. to do better on the exams or tests	1	2		4	5
	4.7	f. in order to obtain extra credit	1	2	3	4	5
	3.1	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	2.9	h. to see what videodiscs are all about					
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	x̄		Lower		Same		Higher	Don't Know
(36)	3.5	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.4	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{X}$		Not at all effective				Very effective	Don't know
38)	2.6	a. understand calculations?	1	2	3	4	5	( )
	3.1	b. understand results?	1	2	3	4	5	( )
0)	3.5	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{X}$		Not at all confident				Very confident	Don't know/ Doesn't apply
41)	3.6	a. using the hardware	1	2	3	4	5	( )
	3.4	b. conducting the experiment	1	2	3	4	5	( )
	3.1	c. reporting results of your experiment	1	2	3	4	5	( )
44)	4.0	d. following instructions	1	2	3	4	5	( )

5) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

74% (1) no
26% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{X}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.4	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.2	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.2	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.2	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.3	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.7	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.0	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.0	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.0	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

			Strongly disagree				Strongly agree	Don't know, Doesn't apply
(55)	3.3	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	2.1	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.4	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.1	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{X}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.4	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.3	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.1	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.6	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{X}$		Not at all effective				Very effective	Don't know
(63)	4.2	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	4.0	b. instructions on the videodisc	1	2	3	4	5	( )
	4.1	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.5	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.9	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.7	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.1	g. explanations	1	2	3	4	5	( )
	3.2	h. quizzes	1	2	3	4	5	( )
	4.1	i. visual images and action (content)	1	2	3	4	5	( )
	4.3	j. quality of the sound	1	2	3	4	5	( )
	4.2	k. quality of the video screen picture	1	2	3	4	5	( )
	4.0	l. readibility of the text on the screen	1	2	3	4	5	( )
	3.9	m. overall production quality	1	2	3	4	5	( )
(76)	3.4	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{X}$								
(77)	2.9	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.9	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.8	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

97% (1) 0
3% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

Climate and Life

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE (N ≃ 72)

Your responses will help improve these activities. Please respond candidly.

1-2) Campus: ______________________ Course: ______________________
3-4) Date: ______________________ Title of Lab Session: ______________

5) 1. What is the general area of your major?

22% (1) undeclared
1% (2) engineering
6% (3) physical sciences
30% (4) biological sciences
___ (5) social sciences
3% (6) humanities
38% (7) other (describe: ______________)

6) 2. What is your approximate grade point average (GPA) at this school?

7% (1) 3.5-4.0
21% (2) 3.0-3.4
17% (3) 2.5-2.9
4% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
51% (7) no GPA yet

7) 3. What is your gender?

39% (1) male
61% (2) female

3) 4. Is English your first language?

95% (1) yes
9) 5% (2) no (what is your first language? ______________________)

5. Prior to this lab session, how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
10)	1.8	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
12)	3.2	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
13)	a. study this same topic in another course?	1 44%	2 43%	3 13%
	b. perform another lab on this same topic?	1 75%	2 15%	3 10%
15)	c. perform this lab before?	1 87%	2 3%	3 10%

7. In minutes, approximately how much time did you spend: (range 0-80)

16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x}$ = 34
19-21) b. in this lab session working on the experiment? $\bar{x}$ = 119 (range 15-180)
22-24) c. outside of lab writing up the report? $\bar{x}$ = 43 (0-150)

25) 8. The amount of time alloted for this lab session was:

4% (1) too much (more than necessary)
37% (2) too little (How much more time was needed? __________)
59% (3) about right

(26) 9. For this lab session, did you work:

34% (1) alone
34% (2) with one other person
9% (3) with two other people
22% (4) with more than two people (How many? _______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same		Higher	Don't know
(27)	3.2	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.2	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't know, Doesn't apply
(29)	2.8	a. understand calculations?	1	2	3	4	5	( )
	3.2	b. understand results?	1	2	3	4	5	( )
31)	3.5	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't know, Doesn't apply
(32)	3.7	a. using the equipment?	1	2	3	4	5	( )
	3.6	b. following instructions?	1	2	3	4	5	( )
	3.4	c. conducting the experiment?	1	2	3	4	5	( )
(35)	3.2	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carrying out the experiment?

87% (1) no
13% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know
37)	3.4	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	2.6	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.4	c.	I was bored most of the time in this lab session.	1	2	3	4	5	( )
	2.4	d.	I was confused most of the time in this lab session.	1	2	3	4	5	( )
	2.4	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.8	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	( )
	1.9	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	( )
(44)	3.0	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	( )

(45) 18. Did you view a videodisc on the topic of this lab?
94%(1) no
6%(2) yes
____(3) don't remember

Thank you for your comments.

Berkeley
Emporia
(N ≃ 11)
Climate & Life

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

1) 1. Please check the one videodisc you will evaluate on this form.

___ (1) Chemistry: Titrations
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
✓ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

2. What is the basis of your familiarity with this videodisc?

		No	Yes, sample portions	Yes, entire videodisc
(2)	a. worked through the videodisc myself	1 22%	2 33%	3 45%
	b. observed students using the disc	1	2 9%	3 91%
4)	c. observed colleague demonstrate the videodisc	1	2 100%	3

3. Prior to viewing this videodisc, how much did you know about:

	$\bar{x}$		No knowledge				Considerable knowledge
(5)	4.5	a. the specific subject matter presented?	1	2	3	4	5
	1.5	b. videodisc technology?	1	2	3	4	5
(7)	2.8	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

	$\bar{x}$		Not nearly as good				Much better	Don't know
(5)	1.9	a. your expectations of it	1	2	3	4	5	( )
	2.0	b. other educational videodiscs	1	2	3	4	5	( )
	2.6	c. standard textbook presentations	1	2	3	4	5	( )
	2.3	d. laboratory manual presentations lab	1	2	3	4	5	( )
(12)	1.3	e. the experience of a laboratory	1	2	3	4	5	( )

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

(13) 73% a. high school students
91% b. college freshmen/sophomores
36% c. college juniors/seniors
46% d. students poorly prepared in math/science
9% e. students well-prepared in math/science
54% f. students learning independently in a student learning center or library
46% g. adults in off-campus learning situations
9% h. replacing a traditional lab
(21) 73 i. supplementing a traditional lab 16

6. Please rate the following features:

	$\bar{x}$		Very poor				Excellent	Not Observed Don't Know
2)	3.1	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.1	b. instructions on the videodisc	1	2	3	4	5	( )
	3.0	c. opportunities to work at own pace	1	2	3	4	5	( )
	2.9	d. opportunities for feedback on answers	1	2	3	4	5	( )
	2.7	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	2.9	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.9	g. explanations	1	2	3	4	5	( )
	3.0	h. quizzes	1	2	3	4	5	( )
	2.8	i. visual images and action (content)	1	2	3	4	5	( )
	3.5	j. quality of the sound	1	2	3	4	5	( )
	3.6	k. quality of the video screen picture	1	2	3	4	5	( )
	2.5	l. quality of the computer text	1	2	3	4	5	( )
	2.7	m. overall production quality	1	2	3	4	5	( )
	2.4	n. student worksheets	1	2	3	4	5	( )
36)	2.2	o. instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

	$\bar{x}$								
,37)	3.1	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.8	b. amount of new information:	too little	1	2	3	4	5	too much
39)	3.2	c. level of information:	too elementary	1	2	3	4	5	too advance

8. Please evaluate this videodisc in terms of:

	$\bar{x}$		Very poor				Excellent	Don't know
40)	3.0	a. accuracy of scientific information	1	2	3	4	5	( )
	3.4	b. currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	2.9	c. relative emphasis given to different concepts	1	2	3	4	5	( )
	2.5	d. appropriate use of examples	1	2	3	4	5	( )
	2.3	e. completeness of coverage of the topic	1	2	3	4	5	( )
	3.1	f. potential fit with course curriculum	1	2	3	4	5	( )
	2.6	g. pedagogical principles employed	1	2	3	4	5	( )
	2.4	h. likelihood of promoting student understanding	1	2	3	4	5	( )
	2.2	i. likelihood of provoking higher order thinking	1	2	3	4	5	( )
	3.2	j. level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	2.9	k. level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	2.3	l. appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	3.0	m. potential to motivate and interest students	1	2	3	4	5	( )
	2.5	n. overall value of the videodisc	1	2	3	4	5	( )
(54)	2.8	o. the concept or potential of videodisc technology	1	2	3	4	5	( )

9. After experiencing or using the videodisc, how likely would you be to do each of the following?

	$\bar{x}$			Not at all likely				Very likely	Don't know
55)	1.9	a.	use videodisc technology in teaching	1	2	3	4	5	( )
	1.5	b.	rent or borrow this disc for use in teaching	1	2	3	4	5	( )
	1.2	c.	purchase this disc for use in teaching	1	2	3	4	5	( )
	2.2	d.	look for better discs on this topic	1	2	3	4	5	( )
	2.1	e.	look for discs on other subjects	1	2	3	4	5	( )
(60)	1.5	f.	develop a videodisc yourself	1	2	3	4	5	( )

10. Please indicate the extent to which you agree or disagree with each of the following statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know
61)	2.5	a.	Videodiscs provide students with opportunities to have experiences they could not have in lab.	1	2	3	4	5	( )
	2.8	b.	Videodiscs provide a degree of individualization that is not achieved by other means.	1	2	3	4	5	( )
	2.0	c.	Videodiscs motivate students to learn in ways a lab cannot.	1	2	3	4	5	( )
(64)	5.0	d.	Videodiscs can never really substitute for hands-on experience.	1	2	3	4	5	( )

11. What do you see as the major strengths of this videodisc?

12. Are there any aspects which need to be changed or improved?

13. What obstacles, if any, do you see to the use of videodiscs in higher education?

14. Any other comments?

(65-66) 15. What is your current position?

60% (1) college or university teacher
___ (2) college or university administrator
30% (3) teaching assistant
10% (4) lab assistant
___ (5) high school teacher or administrator
___ (6) other, please specify:
___

(67-68) 16. What is your major field?

90% (1) biology
___ (2) chemistry
___ (3) physics
___ (4) psychology
10% (5) education
___ (6) other, please specify:
___

(69-70) 17. Name of educational institution with which you are affiliated:

(71-76) 18. Date on which you viewed the videodisc:

Thank you for your cooperation and assistance in evaluating this videodisc.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

1-2) Campus: ______________________ Course: ______________________

Date: ______________________

Respiration
(N ≃ 135)

) Title of videodisc (check one):

___ (1) Chemistry: Titration
✓ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

4) 1. What is the general area of your major?

19% (1) undeclared
5% (2) engineering
5% (3) physical sciences
43% (4) biological sciences
4% (5) social sciences
3% (6) humanities
20% (7) other (describe): ______________________

5) 2. What is your approximate grade point average (GPA) at this school?

21% (1) 3.5-4.0
35% (2) 3.0-3.4
22% (3) 2.5-2.9
6% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
15% (7) no GPA yet

6) 3. What is your gender?

44% (1) male
56% (2) female

(7) 4. Is English your first language?

92% (1) yes
(8) 8% (2) no (what is your first language? ______________________)

5. Prior to this videodisc how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.2	a. using microcomputers?	1	2	3	4	5
	2.1	b. using videodisc players?	1	2	3	4	5
(11)	3.2	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No		Yes		Don't Remember
(12)	a. study this same topic in another course?	1	42%	2	49%	3 9%
	b. perform or view another lab experiment on this same topic?	1	60%	2	37%	3 3%
(14)	c. perform this lab before?	1	72%	2	27%	3 1%

(15) 7. How may separate sessions did you view this videodisc?

92% (1) one
7% (2) two
1% (3) three or more (How many? ________)

8. In minutes, approximately how much time did you spend (range 0-20)

16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{X} = 6$
9-21) b. actually working on the videodisc? $\bar{X} = 72$ (range 5-180)
2-24) c. outside of lab writing up a report? $\bar{X} = 23$ (range 0-105)

25) 9. The amount of time you were allowed for viewing this disc was

15% (1) too much (more than necessary)
5% (2) too little (How much more time was needed? ________________)
80% (3) about right

26) 10. For this lab videodisc, did you work

46% (1) alone
16% (2) with one other person
20% (3) with two other people
18% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

68% (1) yes
32% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{X}$			Not an important reason				A very important reason
(28)	2.3	a.	because the professor or teaching assistant recommended it	1	2	3	4	5
	1.9	b.	because another student recommended it	1	2	3	4	5
	1.6	c.	to get additional help in an area in which I am having difficulties	1	2	3	4	5
	2.7	d.	to learn more about the subject matter	1	2	3	4	5
	2.0	e.	to do better on the exams or tests	1	2	3	4	5
	1.8	f.	in order to obtain extra credit	1	2	3	4	5
	1.7	g.	as a substitute for another assignment or test	1	2	3	4	5
(35)	3.8	h.	to see what videodiscs are all about	1	2	3	4	5
		i.	other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{X}$			Lower		Same		Higher	Don't Know
(36)	3.4	a.	level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.4	b.	interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
38)	2.9	a. understand calculations?	1	2	3	4	5	( )
	3.5	b. understand results?	1	2	3	4	5	( )
10)	3.6	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
41)	3.8	a. using the hardware	1	2	3	4	5	( )
	3.6	b. conducting the experiment	1	2	3	4	5	( )
	3.6	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.0	d. following instructions	1	2	3	4	5	( )

45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

83% (1) no
17% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.5	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.6	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.5	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.1	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.4	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.2	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.0	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.9	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.3	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(55)	3.3	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	2.8	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.1	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.9	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.3	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.2	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.5	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective				Very effective	Don't know
(63)	3.8	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.8	b. instructions on the videodisc	1	2	3	4	5	( )
	4.1	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.7	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.7	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.4	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.5	g. explanations	1	2	3	4	5	( )
	3.5	h. quizzes	1	2	3	4	5	( )
	3.5	i. visual images and action (content)	1	2	3	4	5	( )
	3.9	j. quality of the sound	1	2	3	4	5	( )
	3.8	k. quality of the video screen picture	1	2	3	4	5	( )
	3.9	l. readibility of the text on the screen	1	2	3	4	5	( )
	3.8	m. overall production quality	1	2	3	4	5	( )
(76)	3.5	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	2.8	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.7	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.8	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

46% (1) 0
54% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

Respiration

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE (N≃79)

Your responses will help improve these activities. Please respond candidly.

1-2) Campus: ____________________ Course: ____________________
'-4) Date: ____________________ Title of Lab Session: ____________

) 1. What is the general area of your major?

20% (1) undeclared
3% (2) engineering
9% (3) physical sciences
28% (4) biological sciences
4% (5) social sciences
3% (6) humanities
37% (7) other (describe: ____________)

5) 2. What is your approximate grade point average (GPA) at this school?

10% (1) 3.5-4.0
27% (2) 3.0-3.4
29% (3) 2.5-2.9
10% (4) 2.0-2.4
3% (5) 1.5-1.9
1% (6) below 1.5
19% (7) no GPA yet

7) 3. What is your gender?

43% (1) male
57% (2) female

) 4. Is English your first language?

97% (1) yes
) 3% (2) no (what is your first language? ____________________)

5. Prior to this lab session, how would you rate your skills in:

	$\bar{X}$		Not at all skilled				Very skilled
10)	2.0	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
12)	3.2	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
13)	a. study this same topic in another course?	1 54%	2 38%	3 8%
	b. perform another lab on this same topic?	1 82%	2 9%	3 9%
15)	c. perform this lab before?	1 92%	2 4%	3 4%

7. In minutes, approximately how much time did you spend: (range 0-180

16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{X} = 29$
19-21) b. in this lab session working on the experiment? $\bar{X} = 97$ (range 10-180)
22-24) c. outside of lab writing up the report? $\bar{X} = 27$ (range 0-180)

25) 8. The amount of time alloted for this lab session was:

8% (1) too much (more than necessary)
14% (2) too little (How much more time was needed? ________)
78% (3) about right

'6) 9. For this lab session, did you work:

12% (1) alone
28% (2) with one other person
18% (3) with two other people
42% (4) with more than two people (How many? _______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same	Higher		Don't know
?7)	3.3	a. level of attention in this lab session?	1	2	3	4	5	( )
'8)	3.4	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't know Doesn't apply
29)	2.7	a. understand calculations?	1	2	3	4	5	( )
	3.4	b. understand results?	1	2	3	4	5	( )
-1)	3.4	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't know Doesn't apply
32)	3.8	a. using the equipment?	1	2	3	4	5	( )
	3.7	b. following instructions?	1	2	3	4	5	( )
	3.6	c. conducting the experiment?	1	2	3	4	5	( )
35)	3.4	d. reporting results of your experiment?	1	2	3	4	5	( )

36) 14. During the lab session, did anything occur that interferred with your carrying out the experiment?

92% (1) no
8% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	x̄			Strongly disagree 1	2	3	4	Strongly agree 5	Don't know
37)	3.4	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.5	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.7	c.	I was bored most of the time in this lab session.	1	2	3	4	5	( )
	2.5	d.	I was confused most of the time in this lab session.	1	2	3	4	5	( )
	2.5	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.2	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	( )
	2.2	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	( )
44)	2.8	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	( )

(45) 18. Did you view a videodisc on the topic of this lab?

97% (1) no

3% (2) yes

____(3) don't remember

Thank you for your comments.

Berkeley
Emporia
(N ≃ 8)
Respiration

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

(1) 1. Please check the one videodisc you will evaluate on this form.

___ (1) Chemistry: Titrations	___ (4) Biology: Climate and Life
___ (2) Chemistry: Unknowns	___ (5) Physics: Physics of Motion
✓ (3) Biology: Respiration	___ (6) Physics: Physics of Rotational Motion

2. What is the basis of your familiarity with this videodisc?

			No	Yes, sample portions	Yes, entire videodisc
	$\bar{x}$				
(2)	1.7	a. worked through the videodisc myself	1 43%	2 43%	3 14%
	2.8	b. observed students using the disc	1 13%	2	3 87%
(4)	2.0	c. observed colleague demonstrate the videodisc	1 14%	2 71%	3 14%

3. Prior to viewing this videodisc, how much did you know about:

	$\bar{x}$		No knowledge				Considerable knowledge
(5)	4.4	a. the specific subject matter presented?	1	2	3	4	5
	2.3	b. videodisc technology?	1	2	3	4	5
(7)	3.0	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

	$\bar{x}$		Not nearly as good				Much better	Don't know
(5)	2.6	a. your expectations of it	1	2	3	4	5	( )
	3.0	b. other educational videodiscs	1	2	3	4	5	( )
	2.5	c. standard textbook presentations	1	2	3	4	5	( )
	2.4	d. laboratory manual presentations	1	2	3	4	5	( )
(12)	1.5	[✓ e.] the experience of a laboratory	1 1/26	2	3	4	5	

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

(13) 50% a. high school students
50% b. college freshmen/sophomores
13% c. college juniors/seniors
25% d. students poorly prepared in math/science
38% e. students well-prepared in math/science
63% f. students learning independently in a student learning center or library
63% g. adults in off-campus learning situations
— [✓ h.] replacing a traditional lab
(21) 75% [✓ i.] supplementing a traditional lab 46

6. Please rate the following features:

	$\overline{X}$		Very poor				Excellent	Not Observed Don't Know
(22)	3.0	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.4	b. instructions on the videodisc	1	2	3	4	5	( )
	4.3	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.3	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.0	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	2.8	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.8	g. explanations	1	2	3	4	5	( )
	2.8	h. quizzes	1	2	3	4	5	( )
	3.6	i. visual images and action (content)	1	2	3	4	5	( )
	4.0	j. quality of the sound	1	2	3	4	5	( )
	4.3	k. quality of the video screen picture	1	2	3	4	5	( )
	3.8	l. quality of the computer text	1	2	3	4	5	( )
	3.8	m. overall production quality	1	2	3	4	5	( )
	3.0	n. student worksheets	1	2	3	4	5	( )
(36)	3.0	o. instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

	$\overline{X}$								
(37)	2.4	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.5	b. amount of new information:	too little	1	2	3	4	5	too much
(39)	2.5	c. level of information:	too elementary	1	2	3	4	5	too advance

8. Please evaluate this videodisc in terms of:

	$\overline{X}$		Very poor				Excellent	Don't know
(40)	✓3.8	a. accuracy of scientific information	1	2	3	4	5	( )
	✓3.6	b. currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	✓3.7	c. relative emphasis given to different concepts	1	2	3	4	5	( )
	✓3.7	d. appropriate use of examples	1	2	3	4	5	( )
	✓3.4	e. completeness of coverage of the topic	1	2	3	4	5	( )
	3.6	Ⓕ potential fit with course curriculum	1	2	3	4	5	( )
	✓3.3	g. pedagogical principles employed	1	2	3	4	5	( )
	✓3.1	h. likelihood of promoting student understanding	1	2	3	4	5	( )
	2.3	i. likelihood of provoking higher order thinking	1	2	3	4	5	( )
	✓2.6	j. level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	✓2.8	k. level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	✓3.5	l. appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	2.8	m. potential to motivate and interest students	1	2	3	4	5	( )
	2.5	n. overall value of the videodisc	1	2	3	4	5	( )
(54)	3.0	o. the concept or potential of videodisc technology	1	2	3	4	5	( )

9. After experiencing or using the videodisc, how likely would you be to do each of the following?

	$\bar{x}$		Not at all likely				Very likely	Don't know
(55)	2.5	a. use videodisc technology in teaching	1	2	3	4	5	( )
	2.3	b. rent or borrow this disc for use in teaching	1	2	3	4	5	( )
	1.7	c. purchase this disc for use in teaching	1	2	3	4	5	( )
	2.0	d. look for better discs on this topic	1	2	3	4	5	( )
	2.1	e. look for discs on other subjects	1	2	3	4	5	( )
(60)	2.3	f. develop a videodisc yourself	1	2	3	4	5	( )

10. Please indicate the extent to which you agree or disagree with each of the following statements:

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know
(61)	2.4	a. Videodiscs provide students with opportunities to have experiences they could not have in lab.	1	2	3	4	5	( )
	2.8	b. Videodiscs provide a degree of individualization that is not achieved by other means.	1	2	3	4	5	( )
	3.1	c. Videodiscs motivate students to learn in ways a lab cannot.	1	2	3	4	5	( )
(64)	4.5	d. Videodiscs can never really substitute for hands-on experience.	1	2	3	4	5	( )

11. What do you see as the major strengths of this videodisc?

12. Are there any aspects which need to be changed or improved?

13. What obstacles, if any, do you see to the use of videodiscs in higher education?

14. Any other comments?

(65-66) 15. What is your current position?

50% (1) college or university teacher
____ (2) college or university administrator
38% (3) teaching assistant
12% (4) lab assistant
____ (5) high school teacher or administrator
____ (6) other, please specify:

(67-68) 16. What is your major field?

100% (1) biology
____ (2) chemistry
____ (3) physics
____ (4) psychology
____ (5) education
____ (6) other, please specify:

(69-70) 17. Name of educational institution with which you are affiliated:

(71-76) 18. Date on which you viewed the videodisc:

Thank you for your cooperation and assistance in evaluating this videodisc.

STUDENT REACTION TO VIDEODISC

Titration (N ≃ 55)

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ______________ Course: ______________

Titration (N ≃ 55)

Date: ______________

3) Title of videodisc (check one):

✓ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

9% (1) undeclared
26% (2) engineering
11% (3) physical sciences
36% (4) biological sciences
___ (5) social sciences
___ (6) humanities
17% (7) other (describe): ______________

(5) 2. What is your approximate grade point average (GPA) at this school?

20% (1) 3.5-4.0
24% (2) 3.0-3.4
19% (3) 2.5-2.9
6% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
31% (7) no GPA yet

(6) 3. What is your gender?

66% (1) male
34% (2) female

(7) 4. Is English your first language?

92% (1) yes
(8) 8% (2) no (what is your first language? ______________)

5. Prior to this videodisc how would you rate your skills in

$\bar{X}$		Not at all skilled				Very skilled
(9) 2.4	a. using microcomputers?	1	2	3	4	5
1.8	b. using videodisc players?	1	2	3	4	5
(11) 2.9	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 66%	2 34%	3
	b. perform or view another lab experiment on this same topic?	1 72%	2 28%	3
(14)	c. perform this lab before?	1 83%	2 15%	3 2%

(15) 7. How many separate sessions did you view this videodisc?

89% (1) one
6% (2) two
5% (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (range 0-60)

16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$: 9
.9-21) b. actually working on the videodisc? $\bar{x}$:45 (range 0-120)
:2-24) c. outside of lab writing up a report? $\bar{x}$: 13 (range 0-120)

?5) 9. The amount of time you were allowed for viewing this disc was

16 % (1) too much (more than necessary)
10 % (2) too little (How much more time was needed? ________)
74 % (3) about right

26) 10. For this lab videodisc, did you work

49 % (1) alone
40 % (2) with one other person
11 % (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

6 % (1) yes
94 % (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	3.5	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.6	b. because another student recommended it	1	2	3	4	5
	3.2	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	4.5	d. to learn more about the subject matter	1	2	3	4	5
	4.1	e. to do better on the exams or tests	1	2	3	4	5
	1.4	f. in order to obtain extra credit	1	2	3	4	5
	1.4	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	2.9	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.[illegible]	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.6	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{X}$		Not at all effective				Very effective	Don't know
38)	2.4	a. understand calculations?	1	2	3	4	5	( )
	3.3	b. understand results?	1	2	3	4	5	( )
10)	3.9	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{X}$		Not at all confident				Very confident	Don't know/ Doesn't appl
.41)	3.4	a. using the hardware	1	2	3	4	5	( )
	3.1	b. conducting the experiment	1	2	3	4	5	( )
	3.0	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	3.7	d. following instructions	1	2	3	4	5	( )

45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

61% (1) no
39% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{X}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	2.8	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.4	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.8	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.4	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.6	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.6	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.9	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.0	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.2	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

			Strongly disagree				Strongly agree	Don't know, Doesn't appl
(55)	3.8	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.5	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.8	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.9	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.4	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.8	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.4	c. using the keyboard?	1	2	3	4	5	( )
(62)	2.1	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective				Very effective	Don't know
(63)	3.9	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.6	b. instructions on the videodisc	1	2	3	4	5	( )
	4.5	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.9	d. opportunities for feedback on answers	1	2	3	4	5	( )
	4.0	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	4.2	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.8	g. explanations	1	2	3	4	5	( )
	3.3	h. quizzes	1	2	3	4	5	( )
	4.1	i. visual images and action (content)	1	2	3	4	5	( )
	4.0	j. quality of the sound	1	2	3	4	5	( )
	3.5	k. quality of the video screen picture	1	2	3	4	5	( )
	3.9	l. readibility of the text on the screen	1	2	3	4	5	( )
	4.1	m. overall production quality	1	2	3	4	5	( )
(76)	3.2	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	2.9	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.0	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

Titration

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE (N ≃ 34)

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: ______________ Course: ______________
3-4) Date: ______________ Title of Lab Session: ______________

(5) 1. What is the general area of your major?

9% (1) undeclared
24% (2) engineering
18% (3) physical sciences
36% (4) biological sciences
___ (5) social sciences
___ (6) humanities
12% (7) other (describe: ______________)

(6) 2. What is your approximate grade point average (GPA) at this school?

6% (1) 3.5-4.0
41% (2) 3.0-3.4
27% (3) 2.5-2.9
18% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
9% (7) no GPA yet

(7) 3. What is your gender?

76% (1) male
24% (2) female

8) 4. Is English your first language?

76% (1) yes
9) 24% (2) no (what is your first language? ______________)

5. Prior to this lab session, how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
(10)	1.9	a. using microcomputers?	1	2	3	4	5
	1.7	b. using videodisc players?	1	2	3	4	5
(12)	3.0	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 50%	2 44%	3 6%
	b. perform another lab on this same topic?	1 71%	2 18%	3 12%
(15)	c. perform this lab before?	1 71%	2 24%	3 6%

7. In minutes, approximately how much time did you spend: (range 0-12

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x}$ = 36
(19-21) b. in this lab session working on the experiment? $\bar{x}$ = 130 (range 0-330)
(22-24) c. outside of lab writing up the report? $\bar{x}$ = 126 (range 30-300)

(25) 8. The amount of time alloted for this lab session was:

12% (1) too much (more than necessary)
6% (2) too little (How much more time was needed? __________)
82% (3) about right

6) 9. For this lab session, did you work:

100% (1) alone
____ (2) with one other person
____ (3) with two other people
____ (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

			Lower		Same		Higher	Don't know
	$\bar{x}$							
27)	3.4	a. level of attention in this lab session?	1	2	3	4	5	( )
28)	3.2	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't know/ Doesn't apply
29)	2.8	a. understand calculations?	1	2	3	4	5	( )
	3.1	b. understand results?	1	2	3	4	5	( )
31)	3.1	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
32)	3.4	a. using the equipment?	1	2	3	4	5	( )
	3.4	b. following instructions?	1	2	3	4	5	( )
	3.2	c. conducting the experiment?	1	2	3	4	5	( )
35)	2.9	d. reporting results of your experiment?	1	2	3	4	5	( )

36) 14. During the lab session, did anything occur that interferred with your carrying out the experiment?

78% (1) no
22% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know
37)	3.1	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.1	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.6	c.	I was bored most of the time in this lab session.	1	2	3	4	5	( )
	2.8	d.	I was confused most of the time in this lab session.	1	2	3	4	5	( )
	2.6	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.5	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	( )
	2.3	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	( )
(44)	2.8	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	( )

(45) 18. Did you view a videodisc on the topic of this lab?

63%(1) no
37%(2) yes
____(3) don't remember

Thank you for your comments.

WISC
Titration
Summer 83

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

(N= 10)

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

(1) 1. Please check the one videodisc you will evaluate on this form.

- ___ (1) Chemistry: Titrations
- ___ (2) Chemistry: Unknowns
- ___ (3) Biology: Respiration
- ___ (4) Biology: Climate and Life
- ___ (5) Physics: Physics of Motion
- ___ (6) Physics: Physics of Rotational Motion

2. What is the basis of your familiarity with this videodisc?

		No	Yes, sample portions	Yes, entire videodisc
(2)	a. worked through the videodisc myself	1	2 40%	3 60%
	b. observed students using the disc	1 68%	2 32%	3
(4)	c. observed colleague demonstrate the videodisc	1 43%	2 43%	3 14%

3. Prior to viewing this videodisc, how much did you know about:

	$\bar{x}$		No knowledge				Considerable knowledge
(5)	4.4	a. the specific subject matter presented?	1	2	3	4	5
	2.1	b. videodisc technology?	1	2	3	4	5
(7)	2.9	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

	$\bar{x}$		Not nearly as good				Much better	Don't know
(5)	2.3	a. your expectations of it	1	2	3	4	5	( )
	4.0	b. other educational videodiscs	1	2	3	4	5	( )
	2.9	c. standard textbook presentations	1	2	3	4	5	( )
	3.0	d. laboratory manual presentations	1	2	3	4	5	( )
(12)	1.2	e. the experience of a laboratory	1	2	3	4	5	( )

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

(13) 100% a. high school students
50% b. college freshmen/sophomores
20% c. college juniors/seniors
30% d. students poorly prepared in math/science
30% e. students well-prepared in math/science
40% f. students learning independently in a student learning center or library
30% g. adults in off-campus learning situations
— h. replacing a traditional lab
(21) 60% i. supplementing a traditional lab

6. Please rate the following features:

	$\bar{X}$		Very poor				Excellent	Not Observed/ Don't Know
'2)	3.9	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.3	b. instructions on the videodisc	1	2	3	4	5	( )
	4.3	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.2	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.7	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.3	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.3	g. explanations	1	2	3	4	5	( )
	1.7	h. quizzes	1	2	3	4	5	( )
	3 2	i. visual images and action (content)	1	2	3	4	5	( )
	4.1	j. quality of the sound	1	2	3	4	5	( )
	4.1	k. quality of the video screen picture	1	2	3	4	5	( )
	3 8	l. quality of the computer text	1	2	3	4	5	( )
	3 9	m. overall production quality	1	2	3	4	5	( )
	3.6	n. student worksheets	1	2	3	4	5	( )
36)	3 7	o. instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

37)	3.3	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.1	b. amount of new information:	too little	1	2	3	4	5	too much
39)	2.8	c. level of information:	too elementary	1	2	3	4	5	too advanced

8. Please evaluate this videodisc in terms of:

			Very poor				Excellent	Don't know
40)	4.4	a. accuracy of scientific information	1	2	3	4	5	( )
	4.3	b. currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	3.3	c. relative emphasis given to different concepts	1	2	3	4	5	( )
	4.0	d. appropriate use of examples	1	2	3	4	5	( )
	3.8	e. completeness of coverage of the topic	1	2	3	4	5	( )
	3,6	f. potential fit with course curriculum	1	2	3	4	5	( )
	2.8	g. pedagogical principles employed	1	2	3	4	5	( )
	2.8	h. likelihood of promoting student understanding	1	2	3	4	5	( )
	2.5	i. likelihood of provoking higher order thinking	1	2	3	4	5	( )
	3.2	j. level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	3,2	k. level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	3,7	l. appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	2.8	m. potential to motivate and interest students	1	2	3	4	5	( )
	2.9	n. overall value of the videodisc	1	2	3	4	5	( )
54)	4.1	o. the concept or potential of videodisc technology	1	2	3	4	5	( )

9. After experiencing or using the videodisc, how likely would you be to do each of the following?

	$\bar{x}$		Not at all likely				Very likely	Don't know
5)	2.4	a. use videodisc technology in teaching	1	2	3	4	5	( )
	2.2	b. rent or borrow this disc for use in teaching	1	2	3	4	5	( )
	1.4	c. purchase this disc for use in teaching	1	2	3	4	5	( )
	3.1	d. look for better discs on this topic	1	2	3	4	5	( )
	3.3	e. look for discs on other subjects	1	2	3	4	5	( )
0)	1.4	f. develop a videodisc yourself	1	2	3	4	5	( )

10. Please indicate the extent to which you agree or disagree with each of the following statements:

			Strongly disagree				Strongly agree	Don't know
1)	2.1	a. Videodiscs provide students with opportunities to have experiences they could not have in lab.	1	2	3	4	5	( )
	2.6	b. Videodiscs provide a degree of individualization that is not achieved by other means.	1	2	3	4	5	( )
	2.4	c. Videodiscs motivate students to learn in ways a lab cannot.	1	2	3	4	5	( )
4)	4.1	d. Videodiscs can never really substitute for hands-on experience.	1	2	3	4	5	( )

11. What do you see as the major strengths of this videodisc?

12. Are there any aspects which need to be changed or improved?

13. What obstacles, if any, do you see to the use of videodiscs in higher education?

14. Any other comments?

(65-66) 15. What is your current position?

75% (1) college or university teacher
13% (2) college or university administrator
13% (3) teaching assistant
____ (4) lab assistant
____ (5) high school teacher or administrator
____ (6) other, please specify:

(67-68) 16. What is your major field?

13% (1) biology
87% (2) chemistry
____ (3) physics
____ (4) psychology
____ (5) education
____ (6) other, please specify:

(69-70) 17. Name of educational institution with which you are affiliated:

(71-76) 18. Date on which you viewed the videodisc:

Thank you for your cooperation and assistance in evaluating this videodisc.

STUDENT REACTION TO VIDEODISC

Unknowns
(N ≃ 21)

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

1-2) Campus: ____________________ Course: ____________________

Date: ____________________

Unknowns
(N ≃ 21)

3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
✓ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

4) 1. What is the general area of your major?

5% (1) undeclared
25% (2) engineering
45% (3) physical sciences
___ (4) biological sciences
5% (5) social sciences
___ (6) humanities
20% (7) other (describe): ____________________

5) 2. What is your approximate grade point average (GPA) at this school?

33% (1) 3.5-4.0
29% (2) 3.0-3.4
29% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
9% (7) no GPA yet

6) 3. What is your gender?

57% (1) male
43% (2) female

7) 4. Is English your first language?

82% (1) yes
(8) 18% (2) no (what is your first language? ____________________)

5. Prior to this videodisc how would you rate your skills in

	$\bar{X}$		Not at all skilled				Very skilled
(9)	1.9	a. using microcomputers?	1	2	3	4	5
	1.7	b. using videodisc players?	1	2	3	4	5
(11)	3.1	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 57%	2 43%	3
	b. perform or view another lab experiment on this same topic?	1 57%	2 43%	3
(14)	c. perform this lab before?	1 57%	2 38%	3 5%

(15) 7. How many separate sessions did you view this videodisc?

75% (1) one
10% (2) two
15% (3) three or more (How many? ______)

(range 0-30

8. In minutes, approximately how much time did you spend

.6-18) a. in preparation before you actually began working on the videodisc lab? x̄= 5

19-21) b. actually working on the videodisc? x̄ = 42 (range 0-150)

:2-24) c. outside of lab writing up a report? x̄ = 3 (range 0-24)

.25) 9. The amount of time you were allowed for viewing this disc was

5% (1) too much (more than necessary)
20% (2) too little (How much more time was needed? ____________)
75% (3) about right

26) 10. For this lab videodisc, did you work

76% (1) alone
24% (2) with one other person
___ (3) with two other people
___ (4) with more than two people

.27) 11. Was it required that you view this videodisc?

5% (1) yes
95% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	x̄			Not an important reason				A very important reason
(28)	2.8	a.	because the professor or teaching assistant recommended it	1	2	3	4	5
	1.5	b.	because another student recommended it	1	2	3	4	5
	2.8	c.	to get additional help in an area in which I am having difficulties	1	2	3	4	5
	3.6	d.	to learn more about the subject matter	1	2	3	4	5
	3.4	e.	to do better on the exams or tests	1	2	3	4	5
	1.4	f.	in order to obtain extra credit	1	2	3	4	5
	1.7	g.	as a substitute for another assignment or test	1	2	3	4	5
(35)	3.3	h.	to see what videodiscs are all about	1	2	3	4	5
		i.	other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	x̄			Lower		Same		Higher	Don't Know
(36)	4.0	a.	level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.8	b.	interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
8)	1.8	a. understand calculations?	1	2	3	4	5	( )
	2.9	b. understand results?	1	2	3	4	5	( )
10)	2.9	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
41)	3.6	a. using the hardware	1	2	3	4	5	( )
	3.3	b. conducting the experiment	1	2	3	4	5	( )
	3.1	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.0	d. following instructions	1	2	3	4	5	( )

45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

76%(1) no
24%(2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	2.8	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.4	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.9	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.0	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.6	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.1	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.0	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.8	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.9	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

				Strongly disagree				Strongly agree	Don't know/ Doesn't apply
55)	3.2	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	2.8	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.5	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.4	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.1	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.4	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.1	c.	using the keyboard?	1	2	3	4	5	( )
62)	1.2	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don't know
63)	3.7	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.8	b.	instructions on the videodisc	1	2	3	4	5	( )
	4.1	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3.4	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.5	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.3	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.0	g.	explanations	1	2	3	4	5	( )
	2.9	h.	quizzes	1	2	3	4	5	( )
	3.5	i.	visual images and action (content)	1	2	3	4	5	( )
	3.0	j.	quality of the sound	1	2	3	4	5	( )
	3.1	k.	quality of the video screen picture	1	2	3	4	5	( )
	3.5	l.	readibility of the text on the screen	1	2	3	4	5	( )
	3.6	m.	overall production quality	1	2	3	4	5	( )
(76)	2.4	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	3.5	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.0	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

81% (1) 0
10% (2) 1
9% (3) don't remember

25. Please make other comments about this videodisc, if you wish.

Wisconsin
Unknowns
(N≥4 staff)

Wisconsin
Unknowns
Summer '83

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

(N=4)

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

(1) 1. Please check the one videodisc you will evaluate on this form.

___ (1) Chemistry: Titrations
_✓_ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

2. What is the basis of your familiarity with this videodisc?

		No	Yes, sample portions	Yes, entire videodisc
(2)	a. worked through the videodisc myself	1	2 67%	3 33%
	b. observed students using the disc	1 50%	2 50%	3
(4)	c. observed colleague demonstrate the videodisc	1 67%	2 33%	3

3. Prior to viewing this videodisc, how much did you know about:

	$\bar{x}$		No knowledge				Considerable knowledge
(5)	4.3	a. the specific subject matter presented?	1	2	3	4	5
	1.7	b. videodisc technology?	1	2	3	4	5
(7)	3.3	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

			Not nearly as good				Much better	Don't know
(5)	4.2	a. your expectations of it	1	2	3	4	5	( )
	4.0	b. other educational videodiscs	1	2	3	4	5	( )
	3.0	c. standard textbook presentations	1	2	3	4	5	( )
	3.0	d. laboratory manual presentations	1	2	3	4	5	( )
(12)	2.7	e. the experience of a laboratory	1	2	3	4		

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

(13) 100% a. high school students
100% b. college freshmen/sophomores
— c. college juniors/seniors
— d. students poorly prepared in math/science
25% e. students well-prepared in math/science
25% f. students learning independently in a student learning center or library
25% g. adults in off-campus learning situations
— h. replacing a traditional lab
(21) 100% i. supplementing a traditional lab

6. Please rate the following features:

	$\overline{x}$		Very poor				Excellent	Not Observed Don't Know
(22)	2.3	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.0	b. instructions on the videodisc	1	2	3	4	5	( )
	4.5	c. opportunities to work at own pace	1	2	3	4	5	( )
	2.6	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.0	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.5	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.3	g. explanations	1	2	3	4	5	( )
	2.7	h. quizzes	1	2	3	4	5	( )
	3.5	i. visual images and action (content)	1	2	3	4	5	( )
	4.3	j. quality of the sound	1	2	3	4	5	( )
	4.0	k. quality of the video screen picture	1	2	3	4	5	( )
	4.0	l. quality of the computer text	1	2	3	4	5	( )
	3.8	m. overall production quality	1	2	3	4	5	( )
	3.0	n. student worksheets	1	2	3	4	5	( )
(36)	3.0	o. instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

	$\overline{x}$								
(37)	3.5	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.0	b. amount of new information:	too little	1	2	3	4	5	too much
(39)	3.0	c. level of information:	too elementary	1	2	3	4	5	too advance

8. Please evaluate this videodisc in terms of:

	$\overline{x}$		Very poor				Excellent	Don't know
(40)	4.3	a. accuracy of scientific information	1	2	3	4	5	( )
	4.3	b. currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	2.7	c. relative emphasis given to different concepts	1	2	3	4	5	( )
	3.5	d. appropriate use of examples	1	2	3	4	5	( )
	3.5	e. completeness of coverage of the topic	1	2	3	4	5	( )
	2.7	f. potential fit with course curriculum	1	2	3	4	5	( )
	3.3	g. pedagogical principles employed	1	2	3	4	5	( )
	3.3	h. likelihood of promoting student understanding	1	2	3	4	5	( )
	3.6	i. likelihood of provoking higher order thinking	1	2	3	4	5	( )
	3.7	j. level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	3.8	k. level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	4.0	l. appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	2.8	m. potential to motivate and interest students	1	2	3	4	5	( )
	3.5	n. overall value of the videodisc	1	2	3	4	5	( )
(54)	4.0	o. the concept or potential of videodisc technology	1	2	3	4	5	( )

9. After experiencing or using the videodisc, how likely would you be to do each of the following?

			Not at all likely				Very likely	Don't know
(55)	2.3	a. use videodisc technology in teaching	1	2	3	4	5	( )
	2.8	b. rent or borrow this disc for use in teaching	1	2	3	4	5	( )
	1.2	c. purchase this disc for use in teaching	1	2	3	4	5	( )
	2.8	d. look for better discs on this topic	1	2	3	4	5	( )
	4.0	e. look for discs on other subjects	1	2	3	4	5	( )
(60)	1.8	f. develop a videodisc yourself	1	2	3	4	5	( )

10. Please indicate the extent to which you agree or disagree with each of the following statements:

			Strongly disagree				Strongly agree	Don't know
(61)	3.3	a. Videodiscs provide students with opportunities to have experiences they could not have in lab.	1	2	3	4	5	( )
	2.8	b. Videodiscs provide a degree of individualization that is not achieved by other means.	1	2	3	4	5	( )
	2.8	c. Videodiscs motivate students to learn in ways a lab cannot.	1	2	3	4	5	( )
(64)	3.3	d. Videodiscs can never really substitute for hands-on experience.	1	2	3	4	5	( )

11. What do you see as the major strengths of this videodisc?

12. Are there any aspects which need to be changed or improved?

13. What obstacles, if any, do you see to the use of videodiscs in higher education?

14. Any other comments?

(65-66) 15. What is your current position?

100% (1) college or university teacher
____ (2) college or university administrator
____ (3) teaching assistant
____ (4) lab assistant
____ (5) high school teacher or administrator
____ (6) other, please specify:

(67-68) 16. What is your major field?

____ (1) biology
67 % (2) chemistry
33 % (3) physics
____ (4) psychology
____ (5) education
____ (6) other, please specify:

(69-70) 17. Name of educational institution with which you are affiliated:

(71-76) 18. Date on which you viewed the videodisc:

Thank you for your cooperation and assistance in evaluating this videodisc.

Motion
(N≃ 5)

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

(1) 1. Please check the one videodisc you will evaluate on this form.

___ (1) Chemistry: Titrations
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
_✓_ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

2. What is the basis of your familiarity with this videodisc?

		No	Yes, sample portions	Yes, entire videodisc
(2)	a. worked through the videodisc myself	1 20%	2 40%	3 40%
	b. observed students using the disc	1 33%	2 33%	3 33%
(4)	c. observed colleague demonstrate the videodisc	1 33%	2 67%	3

3. Prior to viewing this videodisc, how much did you know about:

	$\bar{x}$		No knowledge				Considerable knowledge
(5)	4.8	a. the specific subject matter presented?	1	2	3	4	5
	2.2	b. videodisc technology?	1	2	3	4	5
(7)	3.2	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

	$\bar{x}$		Not nearly as good				Much better	Don' know
(5)	3.4	a. your expectations of it	1	2	3	4	5	( )
	–	b. other educational videodiscs	1	2	3	4	5	( )
	2.8	c. standard textbook presentations	1	2	3	4	5	( )
	3.3	d. laboratory manual presentations	1	2	3	4	5	( )
(12)	2.6	e. the experience of a laboratory	1	2	3	4	5	( )

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

(13) 60% a. high school students
60% b. college freshmen/sophomores
– c. college juniors/seniors
40% d. students poorly prepared in math/science
20% e. students well-prepared in math/science
40% f. students learning independently in a student learning center or library
60% g. adults in off-campus learning situations
– h. replacing a traditional lab
(21) 40% i. supplementing a traditional lab

6. Please rate the following features:

	$\bar{x}$		Very poor				Excellent	No. Obser Don' Know
(22)	3.7	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.8	b. instructions on the videodisc	1	2	3	4	5	( )
	4.2	c. opportunities to work at own pace	1	2	3	4	5	( )
	2.8	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.8	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.2	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.2	g. explanations	1	2	3	4	5	( )
	3.3	h. quizzes	1	2	3	4	5	( )
	3.3	i. visual images and action (content)	1	2	3	4	5	( )
	3.3	j. quality of the sound	1	2	3	4	5	( )
	4.0	k. quality of the video screen picture	1	2	3	4	5	( )
	3.7	l. quality of the computer text	1	2	3	4	5	( )
	4.0	m. overall production quality	1	2	3	4	5	( )
	3.7	n. student worksheets	1	2	3	4	5	( )
36)	3.3	o. instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

	$\bar{x}$								
37)	2.5	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.5	b. amount of new information:	too little	1	2	3	4	5	too much
39)	2.5	c. level of information:	too elementary	1	2	3	4	5	too advanc

8. Please evaluate this videodisc in terms of:

	$\bar{x}$		Very poor				Excellent	Don't know
40)	4.0	a. accuracy of scientific information	1	2	3	4	5	( )
	3.6	b. currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	3.4	c. relative emphasis given to different concepts	1	2	3	4	5	( )
	3.6	d. appropriate use of examples	1	2	3	4	5	( )
	3.4	e. completeness of coverage of the topic	1	2	3	4	5	( )
	3.0	f. potential fit with course curriculum	1	2	3	4	5	( )
	3.2	g. pedagogical principles employed	1	2	3	4	5	( )
	3.2	h. likelihood of promoting student understanding	1	2	3	4	5	( )
	2.6	i. likelihood of provoking higher order thinking	1	2	3	4	5	( )
	3.0	j. level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	3.0	k. level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	3.6	l. appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	3.2	m. potential to motivate and interest students	1	2	3	4	5	( )
	3.2	n. overall value of the videodisc	1	2	3	4	5	( )
54)	3.8	o. the concept or potential of videodisc technology	1	2	3	4	5	( )

9. After experiencing or using the videodisc, how likely would you be to do each of the following?

	$\bar{X}$			Not at all likely				Very likely	Don kno
(55)	2.4	a.	use videodisc technology in teaching	1	2	3	4	5	(
	2.4	b.	rent or borrow this disc for use in teaching	1	2	3	4	5	(
	2.4	c.	purchase this disc for use in teaching	1	2	3	4	5	(
	2.4	d.	look for better discs on this topic	1	2	3	4	5	(
	2.0	e.	look for discs on other subjects	1	2	3	4	5	(
(60)	1.0	f.	develop a videodisc yourself	1	2	3	4	5	(

10. Please indicate the extent to which you agree or disagree with each of the following statements:

	$\bar{X}$			Strongly disagree				Strongly agree	Don kno
61)	3.6	a.	Videodiscs provide students with opportunities to have experiences they could not have in lab.	1	2	3	4	5	(
	3.8	b.	Videodiscs provide a degree of individualization that is not achieved by other means.	1	2	3	4	5	(
	3.4	c.	Videodiscs motivate students to learn in ways a lab cannot.	1	2	3	4	5	(
64)	3.8	d.	Videodiscs can never really substitute for hands-on experience.	1	2	3	4	5	(

11. What do you see as the major strengths of this videodisc?

12. Are there any aspects which need to be changed or improved?

13. What obstacles, if any, do you see to the use of videodiscs in higher education?

14. Any other comments?

(65-66) 15. What is your current position?

80% (1) college or university teacher
____ (2) college or university administrator
20% (3) teaching assistant
____ (4) lab assistant
____ (5) high school teacher or administrator
____ (6) other, please specify:

(67-68) 16. What is your major field?

20% (1) biology
20% (2) chemistry
60% (3) physics
____ (4) psychology
____ (5) education
____ (6) other, please specify:

(69-70) 17. Name of educational institution with which you are affiliated:

(71-76) 18. Date on which you viewed the videodisc:

Thank you for your cooperation and assistance in evaluating this videodisc.

STUDENT REACTION TO VIDEODISC Physics

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

-2) Campus: ______ Course: Energy

Date: ______ (N≃161)

Title of videodisc (check one):

___ (1) Chemistry: Titration	___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration	___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion	✓ (6) Physics: ~~Physics of Rotational Motion~~ Energy Transformation

1. What is the general area of your major?

1% (1) undeclared	6% (4) biological sciences
83% (2) engineering	1% (5) social sciences
6% (3) physical sciences	___ (6) humanities
	4% (7) other (describe): ______

2. What is your approximate grade point average (GPA) at this school?

31% (1) 3.5-4.0	4% (4) 2.0-2.4
41% (2) 3.0-3.4	___ (5) 1.5-1.9
24% (3) 2.5-2.9	___ (6) below 1.5
	1% (7) no GPA yet

3. What is your gender?

89% (1) male
11% (2) female

4. Is English your first language?

94% (1) yes
6% (2) no (what is your first language? ______)

5. Prior to this videodisc how would you rate your skills in

$\bar{x}$		Not at all skilled				Very skilled
3.1	a. using microcomputers?	1	2	3	4	5
2.1	b. using videodisc players?	1	2	3	4	5
3.0	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

	No	Yes	Don't Remember
a. study this same topic in another course?	1 20%	2 78%	3 2%
b. perform or view another lab experiment on this same topic?	1 74%	2 22%	3 4%
c. perform this lab before?	1 98%	2 1%	3 1%

) 7. How many separate sessions did you view this videodisc?

48% (1) one 42% (2) two 10% (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 15$
-21) b. actually working on the videodisc? $\bar{x} = 163$
24) c. outside of lab writing up a report? $\bar{x} = 107$

) 9. The amount of time you were allowed for viewing this disc was

5% (1) too much (more than necessary)
52% (2) too little (How much more time was needed? ________________)
43% (3) about right

10. For this lab videodisc, did you work

– (1) alone
22% (2) with one other person
32% (3) with two other people
46% (4) with more than two people

, 11. Was it required that you view this videodisc?

42% (1) yes
58% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

$\bar{x}$		Not an important reason				A very important reason
2.7	a. because the professor or teaching assistant recommended it	1	2	3	4	5
1.5	b. because another student recommended it	1	2	3	4	5
1.6	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
2.9	d. to learn more about the subject matter	1	2	3	4	5
2.0	e. to do better on the exams or tests	1	2	3	4	5
4.9	f. in order to obtain extra credit	1	2	3	4	5
1.7	g. as a substitute for another assignment or test	1	2	3	4	5
2.1	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

$\bar{x}$		Lower		Same		Higher	Don't Know
3.2	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
3.3	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

$\bar{x}$		Not at all effective				Very effective	Don't know
2.9	a. understand calculations?	1	2	3	4	5	( )
3.2	b. understand results?	1	2	3	4	5	( )
3.6	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

		Not at all confident				Very confident	Don't know/ Doesn't apply
3.5	a. using the hardware	1	2	3	4	5	( )
3.4	b. conducting the experiment	1	2	3	4	5	( )
3.3	c. reporting results of your experiment	1	2	3	4	5	( )
3.5	d. following instructions	1	2	3	4	5	( )

17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

56% (1) no
44% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
3.0	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
3.2	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
2.5	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
2.6	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
2.5	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
2.7	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
2.0	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
2.7	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
2.9	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

	20. (Con.)	Strongly disagree				Strongly agree	Don't know/ Doesn't apply
3.1	j. I would like more labs on videodisc.	1	2	3	4	5	( )
2.5	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
3.1	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
2.1	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
1.4	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
1.2	c. using the keyboard?	1	2	3	4	5	( )
1.8	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

$\bar{x}$		Not at all effective				Very effective	Don't know
3.7	a. printed instructions on "how to begin"	1	2	3	4	5	( )
3.6	b. instructions on the videodisc	1	2	3	4	5	( )
3.8	c. opportunities to work at own pace	1	2	3	4	5	( )
3.3	d. opportunities for feedback on answers	1	2	3	4	5	( )
3.5	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
3.3	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
3.0	g. explanations	1	2	3	4	5	( )
3.2	h. quizzes	1	2	3	4	5	( )
4.1	i. visual images and action (content)	1	2	3	4	5	( )
4.0	j. quality of the sound	1	2	3	4	5	( )
4.3	k. quality of the video screen picture	1	2	3	4	5	( )
4.2	l. readibility of the text on the screen	1	2	3	4	5	( )
3.9	m. overall production quality	1	2	3	4	5	( )
3.2	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

$\bar{x}$								
3.0	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
2.6	b. amount of new information:	too little	1	2	3	4	5	too much
2.9	c. level of information:	too elementary	1	2	3	4	5	too advanced

24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

89% (1) 0
9% (2) 1
2% (3) don't remember

25. Please make other comments about this videodisc, if you wish.

Energy
(N ≃ 7)

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

1. Please check the one videodisc you will evaluate on this form.

___ (1) Chemistry: Titrations
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
_✓_ (6) Physics: ~~Physics of Rotational Motion~~ Energy

2. What is the basis of your familiarity with this videodisc?

	No	Yes, sample portions	Yes, entire videodisc
a. worked through the videodisc myself	1 14%	2 43%	3 43%
b. observed students using the disc	1 67%	2 33%	3
c. observed colleague demonstrate the videodisc	1 50%	2 50%	3

3. Prior to viewing this videodisc, how much did you know about:

$\bar{X}$		No knowledge				Considerable knowledge
4.6	a. the specific subject matter presented?	1	2	3	4	5
3.0	b. videodisc technology?	1	2	3	4	5
3.4	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

$\bar{X}$		Not nearly as good				Much better	Don't know
2.4	a. your expectations of it	1	2	3	4	5	( )
4.5	b. other educational videodiscs	1	2	3	4	5	( )
2.7	c. standard textbook presentations	1	2	3	4	5	( )
2.7	d. laboratory manual presentations	1	2	3	4	5	( )
2.4	e. the experience of a laboratory	1	2	3	4	5	( )

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

57% a. high school students
71% b. college freshmen/sophomores
14% c. college juniors/seniors
29% d. students poorly prepared in math/science.
43% e. students well-prepared in math/science
57% f. students learning independently in a student learning center or library
43% g. adults in off-campus learning situations
29% h. replacing a traditional lab
57% i. supplementing a traditional lab

6. Please rate the following features:

	$\bar{x}$		Very poor				Excellent	Not Observe Don't Know
22)	3.0	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.3	b. instructions on the videodisc	1	2	3	4	5	( )
	3.2	c. opportunities to work at own pace	1	2	3	4	5	( )
	2.8	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.0	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	1.5	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.3	g. explanations	1	2	3	4	5	( )
	2.3	h. quizzes	1	2	3	4	5	( )
	2 8	i. visual images and action (content)	1	2	3	4	5	( )
	4.3	j. quality of the sound	1	2	3	4	5	( )
	4.6	k. quality of the video screen picture	1	2	3	4	5	( )
	3.2	l. quality of the computer text	1	2	3	4	5	( )
	3 8	m. overall production quality	1	2	3	4	5	( )
	4.0	n. student worksheets	1	2	3	4	5	( )
36)	3.5	o. instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

	$\bar{x}$								
37)	2.6	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.4	b. amount of new information:	too little	1	2	3	4	5	too much
39)	2.4	c. level of information:	too elementary	1	2	3	4	5	too advance

8. Please evaluate this videodisc in terms of:

	$\bar{x}$		Very poor				Excellent	Don't know
0)	3.6	a. accuracy of scientific information	1	2	3	4	5	( )
	3.2	b. currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	2.5	c. relative emphasis given to different concepts	1	2	3	4	5	( )
	3.4	d. appropriate use of examples	1	2	3	4	5	( )
	3 0	e. completeness of coverage of the topic	1	2	3	4	5	( )
	3.2	f. potential fit with course curriculum	1	2	3	4	5	( )
	3 3	g. pedagogical principles employed	1	2	3	4	5	( )
	3.4	h. likelihood of promoting student understanding	1	2	3	4	5	( )
	3.3	i. likelihood of provoking higher order thinking	1	2	3	4	5	( )
	3 0	j. level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	2.8	k. level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	3 0	l. appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	2 8	m. potential to motivate and interest students	1	2	3	4	5	( )
	2 9	n. overall value of the videodisc	1	2	3	4	5	( )
4)	4.5	o. the concept or potential of videodisc technology	1	2	3	4	5	( )

STUDENT REACTION TO VIDEODISC Physics

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

Campus: ________________ Course: Energy

Date: ________________ (N≃161)

Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
✓ (6) Physics: ~~Physics of Rotational Motion~~ Energy Transformation

1. What is the general area of your major?

1% (1) undeclared
83% (2) engineering
6% (3) physical sciences
6% (4) biological sciences
1% (5) social sciences
___ (6) humanities
4% (7) other (describe): ____________

2. What is your approximate grade point average (GPA) at this school?

31% (1) 3.5-4.0
41% (2) 3.0-3.4
24% (3) 2.5-2.9
4% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
1% (7) no GPA yet

3. What is your gender?

89% (1) male
11% (2) female

4. Is English your first language?

94% (1) yes
6% (2) no (what is your first language? ____________)

5. Prior to this videodisc how would you rate your skills in

$\bar{X}$		Not at all skilled				Very skilled
3.1	a. using microcomputers?	1	2	3	4	5
2.1	b. using videodisc players?	1	2	3	4	5
3.0	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

	No	Yes	Don't Remember
a. study this same topic in another course?	1 20%	2 78%	3 2%
b. perform or view another lab experiment on this same topic?	1 74%	2 22%	3 4%
c. perform this lab before?	1 98%	2 1%	3 1%

7. How may separate sessions did you view this videodisc?

48% (1) one
42% (2) two
10% (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 15$
-21) b. actually working on the videodisc? $\bar{x} = 163$
24) c. outside of lab writing up a report? $\bar{x} = 107$

) 9. The amount of time you were allowed for viewing this disc was

5% (1) too much (more than necessary)
52% (2) too little (How much more time was needed? ________________)
43% (3) about right

10. For this lab videodisc, did you work

- (1) alone
22% (2) with one other person
32% (3) with two other people
46% (4) with more than two people

, 11. Was it required that you view this videodisc?

42% (1) yes
58% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

$\bar{x}$			Not an important reason				A very important reason
2.7	a.	because the professor or teaching assistant recommended it	1	2	3	4	5
1.5	b.	because another student recommended it	1	2	3	4	5
1.6	c.	to get additional help in an area in which I am having difficulties	1	2	3	4	5
2.9	d.	to learn more about the subject matter	1	2	3	4	5
2.0	e.	to do better on the exams or tests	1	2	3	4	5
4.9	f.	in order to obtain extra credit	1	2	3	4	5
1.7	g.	as a substitute for another assignment or test	1	2	3	4	5
2.1	h.	to see what videodiscs are all about	1	2	3	4	5
	i.	other (please describe)					

13. Compared to other sessions in this course, how would you rate your

$\bar{x}$			Lower		Same		Higher	Don't Know
3.2	a.	level of attention in this videodisc lab?	1	2	3	4	5	( )
3.3	b.	interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

$\bar{x}$			Not at all effective				Very effective	Don't know
2.9	a.	understand calculations?	1	2	3	4	5	( )
3.2	b.	understand results?	1	2	3	4	5	( )
3.6	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

			Not at all confident				Very confident	Don't know/ Doesn't apply
3.5	a.	using the hardware	1	2	3	4	5	( )
3.4	b.	conducting the experiment	1	2	3	4	5	( )
3.3	c.	reporting results of your experiment	1	2	3	4	5	( )
3.5	d.	following instructions	1	2	3	4	5	( )

17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

56% (1) no

44% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
3.0	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
3.2	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
2.5	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
2.6	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
2.5	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
2.7	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
2.0	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
2.7	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
2.9	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

		20. (Con.)	Strongly disagree				Strongly agree	Don't know/ Doesn't apply
3.1	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
2.5	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
3.1	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
2.1	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn't apply
1.2	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
1.4	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
1.2	c.	using the keyboard?	1	2	3	4	5	( )
1.8	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

$\bar{x}$			Not at all effective				Very effective	Don't know
3.7	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
3.6	b.	instructions on the videodisc	1	2	3	4	5	( )
3.8	c.	opportunities to work at own pace	1	2	3	4	5	( )
3.3	d.	opportunities for feedback on answers	1	2	3	4	5	( )
3.5	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
3.3	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
3.0	g.	explanations	1	2	3	4	5	( )
3.2	h.	quizzes	1	2	3	4	5	( )
4.1	i.	visual images and action (content)	1	2	3	4	5	( )
4.0	j.	quality of the sound	1	2	3	4	5	( )
4.3	k.	quality of the video screen picture	1	2	3	4	5	( )
4.2	l.	readibility of the text on the screen	1	2	3	4	5	( )
3.9	m.	overall production quality	1	2	3	4	5	( )
3.2	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

$\bar{x}$									
30	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
2.6	b.	amount of new information:	too little	1	2	3	4	5	too much
2.9	c.	level of information:	too elementary	1	2	3	4	5	too advanced

24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

89% (1) 0
9% (2) 1
2% (3) don't remember

25. Please make other comments about this videodisc, if you wish.

Energy
(N ≃ 7)

VIDEODISC EVALUATION FORM
FOR INSTRUCTIONAL STAFF

Your responses will help us evaluate the quality of the videodisc. Please respond candidly.

1. Please check the one videodisc you will evaluate on this form.

___ (1) Chemistry: Titrations	___ (4) Biology: Climate and Life
___ (2) Chemistry: Unknowns	___ (5) Physics: Physics of Motion
___ (3) Biology: Respiration	_✓_ (6) Physics: ~~Physics of Rotational Motion~~ Energy

2. What is the basis of your familiarity with this videodisc?

	No	Yes, sample portions	Yes, entire videodisc
a. worked through the videodisc myself	1 14%	2 43%	3 43%
b. observed students using the disc	1 67%	2 33%	3
c. observed colleague demonstrate the videodisc	1 50%	2 50%	3

3. Prior to viewing this videodisc, how much did you know about:

$\bar{x}$		No knowledge				Considerable knowledge
4.6	a. the specific subject matter presented?	1	2	3	4	5
3.0	b. videodisc technology?	1	2	3	4	5
3.4	c. other educational technologies (such as computer assisted instruction, audio-tutorial, etc.)?	1	2	3	4	5

4. How does the videodisc compare with:

$\bar{x}$		Not nearly as good				Much better	Don't know
2.4	a. your expectations of it	1	2	3	4	5	( )
4.5	b. other educational videodiscs	1	2	3	4	5	( )
2.7	c. standard textbook presentations	1	2	3	4	5	( )
2.7	d. laboratory manual presentations	1	2	3	4	5	( )
2.4	e. the experience of a laboratory	1	2	3	4	5	( )

5. In general, for which of the following groups do you think this videodisc would be appropriate? (Check all that apply.)

57 % a. high school students
71 % b. college freshmen/sophomores
14 % c. college juniors/seniors
29 % d. students poorly prepared in math/science.
43 % e. students well-prepared in math/science
57 % f. students learning independently in a student learning center or library
43 % g. adults in off-campus learning situations
29 % h. replacing a traditional lab
57 % i. supplementing a traditional lab

6. Please rate the following features:

	$\bar{X}$			Very poor				Excellent	Not Observe Don't Know
22)	3.0	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.3	b.	instructions on the videodisc	1	2	3	4	5	( )
	3.2	c.	opportunities to work at own pace	1	2	3	4	5	( )
	2.8	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.0	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	1.5	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.3	g.	explanations	1	2	3	4	5	( )
	2.3	h.	quizzes	1	2	3	4	5	( )
	2 8	i.	visual images and action (content)	1	2	3	4	5	( )
	4.3	j.	quality of the sound	1	2	3	4	5	( )
	4.6	k.	quality of the video screen picture	1	2	3	4	5	( )
	3.2	l.	quality of the computer text	1	2	3	4	5	( )
	3 8	m.	overall production quality	1	2	3	4	5	( )
	4.0	n.	student worksheets	1	2	3	4	5	( )
36)	3.5	o.	instructor's manual	1	2	3	4	5	( )

7. How would you rate the following aspects of the videodisc for students in your institution?

	$\bar{X}$									
37)	2.6	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.4	b.	amount of new information:	too little	1	2	3	4	5	too much
39)	2.4	c.	level of information:	too elementary	1	2	3	4	5	too advance

8. Please evaluate this videodisc in terms of:

	$\bar{X}$			Very poor				Excellent	Don't know
40)	3.6	a.	accuracy of scientific information	1	2	3	4	5	( )
	3.2	b.	currency or up-to-dateness of scientific information	1	2	3	4	5	( )
	2.5	c.	relative emphasis given to different concepts	1	2	3	4	5	( )
	3.4	d.	appropriate use of examples	1	2	3	4	5	( )
	3 0	e.	completeness of coverage of the topic	1	2	3	4	5	( )
	3.2	f.	potential fit with course curriculum	1	2	3	4	5	( )
	3 3	g.	pedagogical principles employed	1	2	3	4	5	( )
	3.4	h.	likelihood of promoting student understanding	1	2	3	4	5	( )
	3.3	i.	likelihood of provoking higher order thinking	1	2	3	4	5	( )
	30	j.	level of sophistication of the science content for students at your site	1	2	3	4	5	( )
	2.8	k.	level of sophistication of the logic and reasoning for your students	1	2	3	4	5	( )
	3 0	l.	appropriate reading/vocabulary level for the audience	1	2	3	4	5	( )
	2 8	m.	potential to motivate and interest students	1	2	3	4	5	( )
	2 9	n.	overall value of the videodisc	1	2	3	4	5	( )
54)	4.5	o.	the concept or potential of videodisc technology	1	2	3	4	5	( )

9. After experiencing or using the videodisc, how likely would you be to do each of the following?

	$\bar{X}$		Not at all likely				Very likely	Don't know
55)	3.3	a. use videodisc technology in teaching	1	2	3	4	5	( )
	3.1	b. rent or borrow this disc for use in teaching	1	2	3	4	5	( )
	2.5	c. purchase this disc for use in teaching	1	2	3	4	5	( )
	2.4	d. look for better discs on this topic	1	2	3	4	5	( )
	3.5	e. look for discs on other subjects	1	2	3	4	5	( )
60)	3.8	f. develop a videodisc yourself	1	2	3	4	5	( )

10. Please indicate the extent to which you agree or disagree with each of the following statements:

	$\bar{X}$		Strongly disagree				Strongly agree	Don't know
1)	4.3	a. Videodiscs provide students with opportunities to have experiences they could not have in lab.	1	2	3	4	5	( )
	3.6	b. Videodiscs provide a degree of individualization that is not achieved by other means.	1	2	3	4	5	( )
	3.5	c. Videodiscs motivate students to learn in ways a lab cannot.	1	2	3	4	5	( )
4)	3.8	d. Videodiscs can never really substitute for hands-on experience.	1	2	3	4	5	( )

11. What do you see as the major strengths of this videodisc?

12. Are there any aspects which need to be changed or improved?

13. What obstacles, if any, do you see to the use of videodiscs in higher education?

14. Any other comments?

5-66) 15. What is your current position?

80% (1) college or university teacher
____ (2) college or university administrator
20% (3) teaching assistant
____ (4) lab assistant
____ (5) high school teacher or administrator
____ (6) other, please specify:

7-68) 16. What is your major field?

____ (1) biology
____ (2) chemistry
80% (3) physics
____ (4) psychology
____ (5) education
20% (6) other, please specify:

9-70) 17. Name of educational institution with which you are affiliated:

1-76) 18. Date on which you viewed the videodisc:

Thank you for your cooperation and assistance in evaluating this videodisc.

Instructors' Comments
"Climate and Life"
(N=15)

What do you see as the strengths of this videodisc?

- potential of medium
  - efficient use of student time
  - ability to present information visually
  - ability to show students places they may never travel to
  - as supplement to regular class activities
- user control
  - students can select what to study
  - students can repeat sections
- captures student interest
- provides immediate feedback
- opportunity for students to gain relationships among many climates very quickly

Which aspects, if any, need to be changed or improved?

Provide answers to the quizzes
- give the right answer after a student gets the wrong answer 3 times
- too frustrating not to ever know the right answer
- questions send students into circular traps if they can't get the correct answer

Provide better instructions
- need printed instructions on how to begin

Improve the visuals
- need better spacing and more highlighting of important words
- match the animals' names to the pictures shown

Improve user control
- need better movement through the system (forward and backward)
- make it easier to move around in the system and start and stop
- more chances to stop, rewind and review

Pick up the pace
- pace is too slow and pedantic

Correct inaccuracies
- some of the climatograms have the wrong data
- animal choices are wrong: narration describes herbivores and visuals show a fox
- challenge gives erroneous impression that all biomes are encountered when you move up a mountain
- correct the facts in challenge 2: relation between air mass movements and name of currents
- this disc is poor and should not have been sent out without better editing

Better feedback
- students don't receive the type of feedback they need
- worksheets are vague

What obstacles, if any, do you see to the use of videodisc in higher education?

- poor quality of current programs
- conservative attitudes of faculty
- expense of computer, videodisc instruction and space to house units
- equipment is unreliable
- training operators

UC Berkeley Student Open-Ended Comments
"Climate and Life" Videodisc
(N=18)

What 2 or 3 things did you learn from this videodisc?

- how to use a biogeography concept map (3 comments)
- climatograms (3 comments)
- biomes and organisms living in them (4 comments)
- habitats of different animals
- how seasons change
- how rainfall directly determines plant and animal life
- flow of air currents
- no animals live in the desert
- that I prefer a good textbook
- that this lesson is too frustrating and taxing (no right answers are given if you get the wrong answer)

What did you like most about this lab?

- self-pacing (5 comments)
  - flexibility in what to study
  - opportunity to move at my own pace
- motion sequences (6 comments)
- new technology (4 comments)
  - the potential of videodisc
  - the combination of audio and visual information
  - the novelty of this interesting innovation

What suggestions do you have for improving this session?

- improve user control (9 comments)
  - provide more opportunities to quit at any time
  - provide more opportunitities to stop the sequence so students can take notes
  - need to have a rewind or forward system; it's not easy to move around in the system to repeat a sequence or stop a sequence
  - eliminate "You seem to be having trouble..." let students decide if they want to see the TA

- provide answers to the quizzes (5 comments)
  - it's frustrating to get the wrong answer twice and then never learn the correct answer
  - give an explanation on why an answer is wrong

- strengthen the content (10 comments)
  - the material is too basic, easy, simple
  - provide more details; descriptions are inadequate
  - give an overlay of the names of plants and animals shown in the motion sequences
  - explanation of air movement maps is poor
  - information isn't integrated; give an overview of taiga which synthesizes all concepts then do the same for biomes

- pick up the pace of the lesson (5 comments)
    - the lesson dragged; it needs to move faster
    - too much time is spent on choosing programs and subprograms
    - the delays between pictures are too long
- provide more feedback to users (2 comments)
    - in an interactive system the big improvement is that feedback can be given; this lesson does not provide enough feedback (postive comments for right answers or explanations for wrong answers)
- change the location of the disc system (2 comments)
    - need a quieter environment; the current room is too noisy
- improve the handouts (1 comment)
    - questions are asked that were not covered by the videodisc
- improve technical aspects (1 comment)
    - there are jarring changes in audio (from voice to silence) which sometimes seem as if the disc may not be working
- limit the amount of text in the videodisc program (1 comment)

Nebraska
Students' Comments
"Climate and Life" Videodisc
(N= 37)

What 2 or 3 things did you learn from this videodisc?

- how to use a biome concept map
- diversity of plants and animals in different biomes
- what a biome is
- importance of precipitation on life's availability
- how latitude affects climate
- reasons for climate
- how to relate latitude and rainfall and temperature to biomes
- why there are seasons
- axis does not rotate
- computer isn't as a difficult to use as I thought
- discovered a more structured, sequential way of learning

What did you like most about this lab?

Self-pacing
- working at my own pace
- could take my own time
- more relaxing; could move at my own pace
- opportunity to repeat sections

Motion/visuals
- pictures of animals
- could see biomes we study

New technology
- enjoyed working on computer
- takes less time than a regular lab
- liked step by step progression of videodisc

What suggestions do you have for improving this lab session?

Provide answers to quizzes
- it's too frustrating not to have answers after 3 tries
- quiz questions are confusing and vague

Improve content
- provide better explanations of challenges
- not enough substance in content
- challenges are not clear
- make material more indepth

Slow down the pace
- slow down the narration
- announcer moves too fast; we had to listen 3 or 4 times

Use as supplement only
- not practical for all labs

Nebraska
Students' Comments
Climate and Life Traditional Laboratory
(N=28)

What 2 or 3 things did you learn from this laboratory?

- various biomes
- conditions that determine biomes present in specific areas
- how to use a climatogram
- how to graph a biome
- how to find different biomes given the temperature and amount of moisture
- distinct characteristics of biomes
- how to make a climatogram

What did you like most about this lab?

- learning about biomes
- trying to read the graphs
- interesting subject matter
- not having to use scientific equipment
- helped my deductive reasoning
- generally easy
- my lab partner

What suggetions do you have for improving this lab session?

- reduce the number of graph assignments
  - — too many biomes to chart
  - — too many graphs
- better map of world biomes
- quieter environment; too noisy to concentrate
- cut down amount of instructor talking

Emporia
Students' Comments
"Climate and Life" Videodisc
(N= 41)

What 2 or 3 things did you learn from this videodisc?

- what a climatogram is
- how to read a climatogram
- what determines climate
- what a biome is
- what biomes exist in different climates
- how biomes affect life
- how different biomes are interrelated
- types of plants and animals found in different biomes
- how seasons relate to the earth's orbit
- that tropical doesn't mean lots of rain
- how to use a videodisc system
- that 2 hours is about as long as I want to sit in front of a terminal

What did you like most about this lab?

Self-pacing
- could work at my own pace
- being able to skip things
- being able to go back and review material

Motion/visuals
- nice pictures
- films of plants and animals

New technology
- learning to use a computer

What suggestions do you have for improving this lab session?

Improve user control
- frustrating not to be able to move forward and back easily

Provide answers to quizzes
- provide answers
- frustrating not to be able to see right answer
- one of the questions had no answer

Improve content
- provide more on organisms that live within biomes
- give better explanations of material
- information is too vague
- correct errors (e.g., on desert climatogram temperature is wrong)
- improve content: have learned more reading a text

Slow down the pace
- announcer speaks too rapidly

Improve worksheets
- make worksheets correspond to videodisc
- shorten worksheets
- lab sheets didn't correspond to videodisc

Emporia
Students' Comments
Climate and Life Traditional Laboratory
(N= 44)

What 2 or 3 things did you learn from this laboratory?

- different biomes
- different biomes have specific plant and soil textures
- how to classify biomes
- plants and animals that live in different biomes
- how to graph different climates
- location of biomes
- how to graph and compare rain and temperature variation
- seasons are opposite in the southern hemisphere
- how to measure quality of water
- temperature and precipitation in various places
- what lives in biomes
- seasonal changes

What did you like most about this lab?

- learning about different biomes
- learning about the tilt of axis
- preparing graphs and analyzing results
- coloring graphs
- using microscope
- the film
- that it was outdoors

What suggestions do you have for improving this lab session?

- need more time to complete assignment
- reduce the number of graphs
    - 2-4 would make the work less tedious
    - too many graphs
- graph paper was poor
- need better explanations and more instructions

Instructors' Comments
"Respiration"
(N=10)

What do you see as the strengths of this videodisc?

- opportunity to try different variables very quickly without going through the tedium of repeating preliminaries
- students can really see the range of effects of temperature on respiration with a variety of organisms
- captures student attention
- students receive immediate reinforcement

Which aspects, if any, need to be changed or improved?

Improve visuals
  - respiration is pretty boring; it's as dull as watching someone breathe
  - ruler is difficult to read

Improve user control
  - provide more opportunities to stop
  - make the program more interactive
  - make it easier to jump around and restart
  - make it easier to pick up where you left off, if you quit

Provide better explanations
  - explain why the organism dies
  - explain the "bubble"
  - explain the nature of respiration
  - describe relationship between volume and oxygen consumption

Correct inaccuracies
  - check oxygen consumption data on plants

What obstacles, if any, do you see to the use videodisc in higher education?

- cost of equipment, production and space
- faculty inertia
- reliability of equipment; too much down time
- students must be monitored while they use the videodisc and thus this becomes a very labor-intensive activity
- videodisc doesn't really make students think
- availability of software

UC Berkeley
Students' Comments
"Respiration" Videodisc
(N= 44)

What 2 or 3 things did you learn from this videodisc?

- how to use a videodisc
- how temperature relates to respiration
- basic facts about respiration
- proper procedures for experiments
- definitions of dependent and independent variables
- temperature at which organisms die
- frogs are more active at higher temperatures
- it's hard to take readings on a monitor

What did you like most about this lab?

- being able to work at my own speed
- enjoyed responding to questions and getting immediate feedback
- ability to see results of experiment at each temperature
- being able to move fast forward and equilibration (time compression)
- observation of specimens
- interaction with machine kept me interested
- moved faster than a regular lab
- a "live" frog did not have to die
- eliminated petty work required in a regular lab (cleaning equipment)
- accuracy of results which is not always possible in a regular lab
- no intereference from other students

What suggestions do you have for improving this lab session?

Improve user control

- make it so we can stop or go when necessary instead of having to start over from the beginning each time
- need an easy way to rewind the program
- need opportunities to repeat things
- need way to speed up the experiment after equilibration
- need key to correct typos or mistakes

Provide better instructions and explanations

- give instructions a little more slowly
- instructions are not clear
- need more details about the experiment
- sometimes I didn't know what was going on
- give a sample calculation or how they are derived
- provide more background information
- explain the causes of inaccuracies in a real lab
- explain why we get the results we do

Improve the visuals

- the frog and mice picture is the same over and over; vary the picture depending on the time in the experiment
- the picture of the organism doesn't correspond to the time in the experiment
- the resolution of the screen is poor
- more realistic pictures of the organisms
- manometer hard to read
- hard to understand what's going on with the same picture at different temperatures; should speed up or slow down organism

Use as supplement only

- good for extra help if problems are encountered in reg lab
- would be good to view before students do actual experiment
- students don't abosrb as much as when actually doing lab
- scientists work with real specimens not on video
- would be a good supplement but not a replacement for lab
- takes all the work out of lab which is both good and bad
- errors are seemingly eliminated which in a way detracts from learning good lab procedure

UC Berkeley
Students' Comments
Respiration Laboratory
(N=12)

What 2 or 3 things did you learn from this laboratory?
- activity is related to oxygen consumption
- rate of metabolism and relation to temperature
- the cooler it gets the quicker a mouse consumes oxygen
- mice are unpredictable, aggressive

What did you like most about this lab?
- the mouse

Nebraska
Students' Comments
"Respiration" Videodisc
(N= 37)

What 2 or 3 things did you learn from this videodisc?

- differences in rate of respiration among different organisms
- role of temperature in respiration
- at what temperature organisms die
- how temperature affects respiration
- respiration varies among organisms
- mass contributes to respiration rate
- respiration is necessary for all organisms

What did you like most about this lab?

- working on a microcomputer
- that computer does most of the work
- in a regular lab, you can make a mistake; this doesn't happen with a computer
- kept my interest
- speed at which you can do the experiment
- ease and convenience compared to regular lab
- opportunity to work at my own pace and when I wanted to
- determining temperatures at which organisms die

What suggestions do you have for improving this lab session?

Improve user control

- have loops on disc to get out of program more easily
- provide opportunities to get back to main menu at any time

Provide better instructions and explanations

- more complete instructions on how to continue on the temperature you want after the first observation
- directions on student worksheets need to be clearer
- make directions more specific
- have someone available to answer questions

Improve the visuals

- markings on the screen (mm's) are hard to read
- don't show the same picture of organism over and over

Speed up the pace

- make it possible just to check times and temperatures without all the waiting
- the visuals are boring; speed up the pace

Nebraska
Students' Comments
Respiration Laboratory
(N=32)

What 2 or 3 things did you learn from this laboratory?

- cellular respiration goes faster in live cells than dead
- oxygen is used in cellular respiration
- the more oxygen consumed, the greater the respiration rate
- peas consume air
- Boyle's law
- respiration is the exact opposite of photosynthesis
- how temperature affects respiration
- experiments go wrong if not done carefully
- how to observe
- how to write a lab report
- how to use a microscope
- why the dye moves
- how temperature affects volume and pressure

What did you like most about this lab?

- actually seeing the process going on
- seeing how far the dye has moved
- splitting up parts among everyone in lab so we could compare results
- getting negative results
- setting up test tubes and dye structure

What suggestions do you have for improving this lab session?

- better equipment
- more instruction on how to set up apparatus
- clearer directions before we begin
- make sure dead peas are dead

Emporia
Students' Comments
"Respiration" Videodisc
(N= 53)

What 2 or 3 things did you learn from this videodisc?

- how respiration varies
- ways of measuring respiration
- increasing temperature increases rate of respiration
- temperature affects respiration
- organisms have tolerant limits for respiration
- rate of respiration is dependent upon body mass as well as temperature
- at higher temperatures organisms breathe faster and die faster
- the lethal temperature for organisms
- mouse has higher respiration rate
- how to use a videodisc

What did you like most about this lab?

- gathering data in a short time
- convenience and ease of setting up lab
- reinforcement of answers
- feeling in control of the experiment
- being able to determine at what temperature organisms die
- operating the keyboard

What suggestions do you have for improving this lab session?

Improve user control
  - indicate a way to go backward and forward
  - provide opportunity to hear soundtrack again
  - need more flexibility to move around in the program

Provide better explanations and instructions
  - need more explanations on how to do calculations
  - explain how to evaluate the graph
  - describe a control manomenter
  - explain how to complete worksheets
  - instructions for graphing need more detail

Improve the visuals
  - the frog and mouse picture is the same over and over; vary it
  - the mm's were hard to determine, difficult to read

Use as supplement only
  - would prefer to do experiment first and then watch disc
  - can learn more by doing than by watching

Emporia
Students' Comments
Respiration Traditional Laboratory
(N=37)

What 2 or 3 things did you learn from this laboratory?

- organisms respire more when warmer
- lizards respire more than peas
- amount of air in an empty tube doesn't change
- growth of yeast in an incubator
- dormant peas don't respire
- dormant peas even use oxygen
- plants breathe
- temperature affects breathing rate of reptiles
- how respiration changes with temperature
- what respiration is
- differences between anarobic and arobic respiration
- don't pick lizards up by their tails

What did you like most about this lab?

- animals
- chasing lizards
- using the incubator
- slowing down the breathing process

What suggestions do you have for improving this lab session?

- more background information to prepare students for lab
- concluding statements to put experiment in perspective

Wisconsin Instructors' Open-ended Comments (Videodisc)
"Titration"
(N=10)

What do you see as the strengths of this videodisc?

- potential of videodisc (3 comments)
  - — videodisc provides ready access to a substitute method when hands-on lab is not available
  - — opportunities for immediate feedback
  - — the availability of the lesson at any time
- specific content (3 comments)
  - — repetition of concepts
  - — segment on using known solutions
  - — useful as test of pre-lab understanding

Which aspects, if any, need to be changed or improved?

Improve user control (3 comments)
- program doesn't let you skip anything; it would be nice to undertake a procedure without having to go through the entire process from step 1
- improve access to data files
- there were sections that could not be called up

Pick up the pace (2 comments)
- the program seems too long
- the program needs more action

Improve the content (2 comments)
- titration seems somewhat trivial
- there are errors in the programming

Provide better instructions and explanations (2 comments)
- the directions are very incomplete
- students don't know what to do when using this and need instructor prompting

Improve the visuals (1 comment)
- arrange the screen so that the flask can be seen when adding 1/2 drops

What obstacles, if any, do you see to the use of videodisc in higher education?

- cost (6 comments)
- acceptability among faculty
- if videodisc is viewed as a replacement for lab, it will have only limited success. It will never substitute for lab because it doesn't give the practical experience that's needed for lab work. Titration should be experienced hands-on; some chemicals for titration are cheap and readily available. Videodisc will never replace an actual titration.

Wisconsin Students' Open-Ended Comments (Videodisc)
"Titration"
(N=6)

What 2 or 3 things did you learn from this videodisc?

- procedures and purpose of titration (5 comments)
- the importance of clearing out bubbles from the buret
- what it means when there are water droplets clinging on the side of the buret
- how to operate the equipment

What did you like most about this lab?

- opportunity to do a lab alone
- the demonstrations
- this is much more useful than simply reading about the experiment
- the introduction was good

What suggestions do you have for improving this lab session?

Provide better instructions and explanations (2 comments)
- couldn't do tasks without professor's assistance

Eliminate technical problems (2 comments)
- the videodisc jammed and I couldn't complete the program
- the computer was broken and wouldn't start

Improve visuals (2 comments)
- need a better view of the flask while carrying out the titration
- it was difficult to see titration stream going into the container so it was easy to overshoot

Don't substitute this for a real lab (2 comments)
- for the cost of the equipment, this lesson wasn't valuable enough
- real lab is far superior

Wisconsin Students' Open-Ended Comments (Laboratory)
"Titration"
(N=9)

What 2 or 3 things did you learn from this lab session?

- procedures of titration (4 comments)
- practical problems involved in lab work
- process of standardizing

Did anything occur that interferred with your carrying out the experiment?

- the first titration was completed much faster than anticipated with much less titration than expected

What did you like most about this lab session?

- doing the experiment
- the experiment was easy
- seeing the results

What suggestions do you have for improving this lab session?

- more explanations on procedures
- clearer overall picture of what is occurring
- need a math review before this session
- lab was too repetitious

Nebraska
Students' Comments
"Titration" Videodisc
(N= 34)

What 2 or 3 things did you learn from this videodisc?

- making calculations for a titration experiment
- which errors not to make
- clarification of definitions
- how to work a buret with titration
- preparing the buret
- clearning a buret
- how to titrate
- using a card to read a meniscus
- operating a videodisc

What did you like most about his lab?

- doing titration without actually doing titration
- the buret stays clean after titration; is this reality?
- self-pacing; working at my own speed
- if you made a mistake there were no feelings of inferiority
- working on a computer

What suggestions do you have for improving this lab?

Improve user control
- hard to get back to one section if you wanted to repeat a sequence

Provide better explanations
- not clear as to what students are supposed to do
- needed someone around to explain things
- make calculations clearer
- be clear on what students are supposed to do
- give better directions
- not clear what the control button is

Improve the visuals
- improve the picture quality
- better graphics

Improve the audio
- add more audio

Improve reliability of equipment
- stopcock did not operate properly
- stopcock got stuck

UCLA
Students' Comments
"Titration"
(N= 13)

What 2 or 3 things did you learn from this videodisc?

- definitions of acidity and titration
- how to find percent by mass
- use of burets
- splitting drops
- how to clean a buret
- how to work a stopcock
- how to use a videodisc

What did you like most about this lab?

- understanding how titration works
- self-pacing
- opportunity to review material if needed
- using the hardware

What suggestions do you have for improving this lab session?

Improve the visuals
- printed letters are too hard to read
- improve the quality of the pictures

Provide better explanations
- need better explanations and instructions
- provide formulas for calculations, e.g., how to calculate amount of titrant to be added
- pauses between reading the meniscus and adding titrant made experiment difficult

UCLA
Students' Comments
Titration Laboratory
(N=25)

What 2 or 3 things did you learn from this laboratory?
- patience in calculations
- how to use chemical equipment
- calibration
- measurements must be precise
- acid-base ratio is very delicate
- how to weigh a dry sample
- equivalence points

What did you like most about this lab?
- always doing different things
- hands-on experiences
- having base pre-dryed
- using the analytic balance
- actually titrating

What suggestions do you have for improving this lab session?
- more specific initial information
- better preparation and information before the lab
- more electronic equipment
- prefer to work with a partner

Wisconsin Instructors' Open-Ended Comments (Videodisc)
"Unknowns"
(N=5)

What do you see as the strengths of this videodisc?

- clarity; clear instructions (2 comments)
- interesting and challenging problem (2 comments)
- good detective work type of reasoning
- good video picture
- better than titration

Which aspects, if any, need to changed or improved?

Improve user control (2 comments)

- need more exit points
- need a quick way to get out of any loop or set of learning experiences

Provide better instructions and explanations (2 comments)

- need better instructions on how to start up the whole system if no instructor is available
- need better explanation of TARE

Improve the content (2 comments)

- need more complex segments
- need more cations
- allow addition of reagents to precipitate

Improve the visuals (3 comments)

- show some people do the speaking
- have more action
- some of the pictures were not shot close enough

What obstacles, if any, do you see to the use of videodisc in higher education?

- cost (3 comments)
- space
- availability of quality software at appropriate levels
- videodisc won't replace a regular lab

Wisconsin Students' Open-Ended Comments (Videodisc)
"Unknowns"
(N=5)

What 2 or 3 things did you learn from this videodisc?
- to be thorough
- not to waste chemicals when you have a limited supply
- difficulties in determining unknowns
- listening to carbonate fizz
- how to work with a computer
- nothing

What did you like most about this lab?
- no mess to clean up
- the music
- the session seemed to go faster than a regular lab

What suggestions do you have for improving this lab session?

Improve directions and explanations (3 comments)
- reading and understanding the instructions was tedious
- I was at a loss as to how I should approach the experiment
- determining the correct procedure without any basis was frustrating

Provide more interaction (1 comment)
- I wanted opportunities to ask my own questions rather than respond only to the options given in the program

Nebraska
Students' Comments
"Chemical Decision-Making" Videodisc
(N=6)

What 2 or 3 things did you learn from this videodisc?

- how to analyze unknowns
- how to record observations sequentially
- reactions of different reagents on the same cation
- color of reactions is important
- order in which chemicals are added is important
- what a 9 bottle experiment is like

What did you like most about this lab?

- could check results
- can repeat analyses

What suggestions do you have for improving this lab?

Provide better explanations

- explain why things happen
- more explanation of how to get results from specific processes
- better explanations of what to do
- better instructions on how to quit; didn't realize you had to type "y"

UCLA
Students' Comments
"Chemical Decision-Making" Videodisc
(N=12)

What 2 or 3 things did you learn from this videodisc?

- adding reagents systematically to cations helps identify unknowns
- silver reacts with a lot of stuff
- it is not necessary to actually perform a lab in order to learn the point of the lesson of the lab
- the power of reasoning
- it's not hard to use a videodisc system
- didn't learn much at all

What did you like most about this lab?

- opportunity to work at own pace
- working in a simulation; data weren't messed up by lab errors
- time compression; can try more times in less time than actual lab
- involving; fun to use; gives you a feeling of accomplishment

What suggestions do you have for improving this lab session?

Provide better instructions and explanations

- no instruction on how to use videodisc and it took a while to figure it out
- need better explanations of experiment throughout the lab
- make it more understandable
- provide better idea of what is going on

Use as supplement only

- not a substitute for an actual experience but an interesting aid

Instructors' Comments
"Physics of Motion"
(N = 5)

What do you see as the strengths of this videodisc?

- provides information on situations not available in the lab
- innovation is possible
- videodiscs are versatile and can reinforce class lectures if a student is having difficulty

Which aspects, if any, need to be changed or improved?

- program is too "picky;" when locating a center of mass a small area should be acceptable, not one specific point. Too much time is lost attempting to locate one specfic point

- clarify error messages in the instructor's manual

- don't think students would use this very much

- let users out from under author's control

- some sequences go on too long

Illinois Central College
Students' Comments
"Physics of Motion" Videodisc
(N= 30)

What 2 or 3 things did you learn from this videodisc?

- velocity increases with time at a constant rate
- different types of motion
- distance increases with the square to time during free fall
- relationship between acceleration and velocity in up and down motion
- how inertia affects rotational motion
- modern technology can't compare with good old one-to-one teaching

What did you like most about this lab?

- being able to compare human motion to physic principles
- seeing different types of motion
- working at my own speed
- working with others
- it was a change from the regular lab
- using the computer

What suggestions do you have for improving this lab session?

Eliminate pickiness

- when locating center of mass, one small area should be acceptable not one specific point
- too much time is lost in trying to locate a single point
- make it easier to locate specific points
- allow a margin of error in calculations so it will accept 4.7 instead of 4.759
- increase error tolerance, e.g. in graphing sequence

Provide better explanations

- lab is too difficult for those unfamiliar with the material
- give more instruction on the formulas

Improve user control

- allow student to rewind back to earlier parts of the program
- provide fast forward
- if we pushed a wrong button, it took a while to get on track

Improve reliability of system

- system malfunctioned not allowing us to continue
- system IO error prevented completion of lab
- equipment failed
- system IO error #1 P+164 I #102 kept appearing on screen
- lesson malfunctioned
- stopped at FF5 and would not continue

Kansas State
Students' Comments
"Physics of Motion" Videodisc
(N= 11)

What 2 or 3 things did you learn from this videodisc?

- motion can be defined rotationally, veritcally, horizontally
- parabolic nature of combined motions
- learned that you have to be accurate with measurements which is sometimes difficult or computer won't accept entry
- learned to use videodisc system

What did you like most about this lab?

- seeing live pictures helped me understand the concepts of motion
- immediate feedback
- opportunities to set my own pace

What suggestions do you have for improving this lab session?

Eliminate pickiness
- certain answers had to be too precise or you couldn't continue

Provide better explanations
- provide file of formulas students can refer to
- give examples of how to do calculations
- if students get the wrong answer, there is no clue on how to correct it
- unclear what is expected

Increase reliability of the system
- videodisc skipped part of the experiment

Correct inaccuracies
- computer gave wrong answer to one question
- some of the angle measurements in the rotational section were as far as 7 degrees off what we measured (we measured three times)

University of Nebraska
Students' Comments
"Energy Transformation" Videodisc
(N=100)

What 2 or 3 things did you learn from this videodisc?

- energy losses are high; energy is dissipated by friction
- how to calculate forces, work, input energy, output energy
- energy can be transferred by several methods
- wind resistance is proportional to the square of velocity
- ima, ama
- how energy is transmitted through a mechanical system
- how a bicycle works
- once a constant speed is reach, additional energy is not necessary
- all the energy aspects of riding a bike
- how to compute total work for circular motion
- knowledge of energy and work
- exact amount of work needed to ride a bike
- how to figure rolling resistance
- the mechanical advantage
- better understanding of laws of applied physics
- overall energy balance on a bike
- relationship of wind resistance to speed
- how complicated energy transformations really are

What did you like most about this lab?

- earning extra credit points
- interesting to see the physics behind an everyday occurence
- working without pressure
- getting immediate feedback on answers
- self-pacing and flexibility
- opportunity to learn in another way besides lecture
- ease of operation
- learning about the mechanics of a bicycle
- visuals and video footage made concepts interesting and clear

What suggestions do you have for improving this lab?

Eliminate pickiness

- trying to find the exact spot (for + on hub and how far back the bike started on the ramp) is tedious
- it said "the bike isn't quite at the top of the ramp" no matter what number was put in the starting height

Double check answers

- some answers are wrong
- correct wind resistance table

Provide better instructions and explanations

- give instructions on how to use the hardware
- much time was spent trying to figure out the worksheets
- clearer directions
- provide reminders of commands
- make a help library like VAX
- equations for solutions of functions should be more precise
- describe reasons for results and processes
- some things are confusing, e.g., is the work pedal revolution the same for every gear?

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ____________ Course: Berkeley
Climate & Life
Summer 83
(N≈18 students)

Date: ____________

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
✓ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major? (N≈18)

11% (1) undeclared
6% (2) engineering
– (3) physical sciences
22% (4) biological sciences
39% (5) social sciences
5% (6) humanities
17% (7) other (describe): ____________

(5) 2. What is your approximate grade point average (GPA) at this school? (N=17)

12% (1) 3.5-4.0
35% (2) 3.0-3.4
41% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
12% (7) no GPA yet

(6) 3. What is your gender? (N = 18)

28% (1) male
73% (2) female

(7) 4. Is English your first language? 1 each 1 2 3 4 5

72% (1) yes
(8) 28% (2) no (what is your first language? ____________)

5. Prior to this videodisc how would you rate your skills in (N=18)

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.0	a. using microcomputers?	1	2	3	4	5
	1.8	b. using videodisc players?	1	2	3	4	5
(11)	3.1	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you (N=18)

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 67%	2 28%	3 5%
	b. perform or view another lab experiment on this same topic?	1 89%	2 11%	3 –
(14)	c. perform this lab before?	1 94%	2 6%	3 –

(15) 7. How many separate sessions did you view this videodisc? (N=18)

89% (1) one
11% (2) two
– (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (N= 17)

(16-18) a. in preparation before you actually began working on the videodisc lab? 3

(19-21) b. actually working on the videodisc? 61.5 (25 - 120 min)

(22-24) c. outside of lab writing up a report? -

(25) 9. The amount of time you were allowed for viewing this disc was (N=17)

6% (1) too much (more than necessary)
29% (2) too little (How much more time was needed? ________________)
65% (3) about right

(26) 10. For this lab videodisc, did you work (N = 18)

67% (1) alone
28% (2) with one other person
6% (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc? (N=18)

____ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc): (N= 18)

	$\bar{x}$		Not an important reason				A very important reason
(28)	3.3	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	2.0	b. because another student recommended it	1	2	3	4	5
	1.8	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	2.8	d. to learn more about the subject matter	1	2	3	4	5
	1.9	e. to do better on the exams or tests	1	2	3	4	5
	4.3	f. in order to obtain extra credit	1	2	3	4	5
	2.9	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	4.1	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your (N=16)

			Lower		Same		Higher	Don't Know
(36)	2.5	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	2.2	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you (N=15)

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	3.0	a. understand calculations?	1	2	3	4	5	( )
	3.5	b. understand results?	1	2	3	4	5	( )
(40)	3.7	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel (N=15)

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't app
(41)	3.7	a. using the hardware	1	2	3	4	5	( )
	3.7	b. conducting the experiment	1	2	3	4	5	( )
	4.0	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.5	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment? (N=15)

73% (1) no

27% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements (N=16)

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.1	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.2	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.4	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	1.6	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.1	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.3	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.0	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.7	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.4	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

				Strongly disagree				Strongly agree	Don't know/ Doesn't apply
5)	2.8	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	3.1	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	2.8	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
58)	2.1	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems (N=15)

	X̄			No, not at all				Yes, very much so	Don't know/ Doesn't apply
59)	1.4	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.1	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.1	c.	using the keyboard?	1	2	3	4	5	( )
2)	1.2	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features (N=18)

	X̄			Not at all effective				Very effective	Don't know
63)	4.2	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	4.0	b.	instructions on the videodisc	1	2	3	4	5	( )
	4.2	c.	opportunities to work at own pace	1	2	3	4	5	( )
	2.8	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.5	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.1	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.4	g.	explanations	1	2	3	4	5	( )
	2.8	h.	quizzes	1	2	3	4	5	( )
	4.0	i.	visual images and action (content)	1	2	3	4	5	( )
	4.3	j.	quality of the sound	1	2	3	4	5	( )
	4.2	k.	quality of the video screen picture	1	2	3	4	5	( )
	3.7	l.	readibility of the text on the screen	1	2	3	4	5	( )
	3.6	m.	overall production quality	1	2	3	4	5	( )
76)	3.3	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the (N=16)

7)	2.4	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.6	b.	amount of new information:	too little	1	2	3	4	5	too much
79)	2.3	c.	level of information:	too elementary	1	2	3	4	5	too advanced

80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course? (N=17)

94% (1) 0
6% (2) 1
— (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ______________ Course: Nebraska

Date: ______________ Climate & Life
Fall '83
(N = 38)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
✓ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

32% (1) undeclared
6% (2) engineering
16% (3) physical sciences
14% (4) biological sciences
3% (5) social sciences
3% (6) humanities
27% (7) other (describe): ______________

(5) 2. What is your approximate grade point average (GPA) at this school?

25% (1) 3.5-4.0
33% (2) 3.0-3.4
11% (3) 2.5-2.9
6% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
25% (7) no GPA yet

(6) 3. What is your gender?

38% (1) male
62% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ______________)

5. Prior to this videodis how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.4	a. using microcomputers?	1	2	3	4	5
	2.4	b. using videodisc players?	1	2	3	4	5
(11)	3.4	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 49%	2 43%	3 8%
	b. perform or view another lab experiment on this same topic?	1 78%	2 19%	3 3%
(14)	c. perform this lab before?	1 98%	2 2%	3

(15) 7. How many separate sessions did you view this videodisc?

65% (1) one
32% (2) two
3% (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (0-60)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 16$
(19-21) b. actually working on the videodisc? $\bar{x} = 115$ (30-225)
(22-24) c. outside of lab writing up a report? $\bar{x} = 40$ (0-90)

(25) 9. The amount of time you were allowed for viewing this disc was

3% (1) too much (more than necessary)
16% (2) too little (How much more time was needed? ________________)
81% (3) about right

(26) 10. For this lab videodisc, did you work

26% (1) alone
29% (2) with one other person
17% (3) with two other people
29% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100% (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

			Not an important reason				A very important reason
(28)	a.	because the professor or teaching assistant recommended it	1	2	3	4	5
	b.	because another student recommended it	1	2	3	4	5
	c.	to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d.	to learn more about the subject matter	1	2	3	4	5
	e.	to do better on the exams or tests	1	2	3	4	5
	f.	in order to obtain extra credit	1	2	3	4	5
	g.	as a substitute for another assignment or test	1	2	3	4	5
(35)	h.	to see what videodiscs are all about	1	2	3	4	5
	i.	other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$			Lower		Same		Higher	Don't Know
(36)	4.1	a.	level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	4.0	b.	interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.6	a. understand calculations?	1	2	3	4	5	( )
	2.5	b. understand results?	1	2	3	4	5	( )
(40)	3.9	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't app
(41)	3.7	a. using the hardware	1	2	3	4	5	( )
	3.7	b. conducting the experiment	1	2	3	4	5	( )
	3.3	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.3	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

80% (1) no
20% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn' apply
(46)	3.6	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.7	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.2	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.1	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	1.7	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.6	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.3	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	2.1	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

	$\bar{x}$		Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	4.3	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.0	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.7	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.0	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.4	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.4	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.1	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.4	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective				Very effective	Don' know
(63)	4.3	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	4.2	b. instructions on the videodisc	1	2	3	4	5	( )
	4.3	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.9	d. opportunities for feedback on answers	1	2	3	4	5	( )
	4.3	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	4.1	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.5	g. explanations	1	2	3	4	5	( )
	3.6	h. quizzes	1	2	3	4	5	( )
	4.2	i. visual images and action (content)	1	2	3	4	5	( )
	4.3	j. quality of the sound	1	2	3	4	5	( )
	4.2	k. quality of the video screen picture	1	2	3	4	5	( )
	4.2	l. readibility of the text on the screen	1	2	3	4	5	( )
	4.2	m. overall production quality	1	2	3	4	5	( )
(76)	3.6	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	3.1	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.1	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

97% (1) 0
3% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: Nebraska Course: Bio1
(3-4) Date: ____________ Title of Lab session: Climate & Life

(5) 1. What is the general area of your major? N ≃ 28

21% (1) undeclared
___ (2) engineering
12% (3) physical sciences
8% (4) biological sciences
___ (5) social sciences
___ (6) humanities
50% (7) other (describe: ____________)

(6) 2. What is your approximate grade point average (GPA) at this school?

7% (1) 3.5-4.0
29% (2) 3.0-3.4
32% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
32% (7) no GPA yet

(7) 3. What is your gender?

36% (1) male
64% (2) female

(8) 4. Is English your first language?

100% (1) yes
(9) ___ (2) no (what is your first language? ____________)

5. how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
(10)	1.4	a. using microcomputers?	1	2	3	4	5
	2.0	b. using videodisc players?	1	2	3	4	5
(12)	3.3	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 46%	2 43%	3 11%
	b. perform another lab on this same topic?	1 75%	2 21%	3 4%
(15)	c. perform this lab before?	1 89%	2 4%	3 7%

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x}$ = 14.5 (range 0-60)
(19-21) b. in this lab session working on the experiment? $\bar{x}$ = 141 (range 60-180)
(22-24) c. outside of lab writing up the report? $\bar{x}$ = 24 (range 0-90)

(25) 8. The amount of time alloted for this lab session was:

4% (1) too much (more than necessary)
29% (2) too little (How much more time was needed? ________)
67% (3) about right

(26) 9. For this lab session, did you work:

35% (1) alone
23% (2) with one other person
12% (3) with two other people
30% (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$			Lower		Same		Higher	Don't kn
(27)	3.4	a.	level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.2	b.	interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$			Not at all effective				Very effective	Don't kn Doesn't app
(29)	2.9	a.	understand calculations?	1	2	3	4	5	( )
	3.5	b.	understand results?	1	2	3	4	5	( )
(31)	3.8	c.	understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$			Not at all confident				Very confident	Don't kn Doesn't app
(32)	3.7	a.	using the equipment?	1	2	3	4	5	( )
	3.6	b.	following instructions?	1	2	3	4	5	( )
	3.5	c.	conducting the experiment?	1	2	3	4	5	( )
(35)	3.4	d.	reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carryi out the experiment?

89% (1) no
11% (2) yes. Please describe.

15. What did you like most about this lab session?

16. *What suggestions do you have for improving this lab session?*

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don kno
(37)	3.5	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	(
	3.6	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	(
	2.6	c.	I was bored most of the time in this lab session.	1	2	3	4	5	(
	2.3	d.	I was confused most of the time in this lab session.	1	2	3	4	5	(
	2.0	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	(
	2.6	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	(
	1.5	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	(
(44)	2.7	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	(

(45) 18. Did you view a videodisc on the topic of this lab?

100% (1) no
____(2) yes
____(3) don't remember

Thank you for your comments.

Student End of Course Questionnaire

Your responses will help improve aspects of this course. Please respond candidly.

(1) Campus: Nebrasha

N ≃ 23

(2) Course: Biology

(3-6) Date: ____________

(7-8) 1. What is the area of your major?

44% (1) undeclared
4% (2) engineering
____ (3) physical sciences
9% (4) biological sciences
4% (5) social sciences
4% (6) humanities
25% (7) other (describe): ____________

(9) 2. What is your approximate grade point average (GPA) at this school?

13% (1) 3.5-4.0
22% (2) 3.0-3.4
22% (3) 2.5-2.9
4% (4) 2.0-2.4
____ (5) 1.5-1.9
____ (6) below 1.5
39% (7) no GPA yet

(10) 3. During this course, how many different videodiscs did you use?

____ (1) none
____ (2) one
100% (3) two

(11) 4. What is your gender?

35% (1) male
65% (2) female

(12) 5. Is English your first language?

100% (1) yes
(13) ____ (2) no (What is your first language? ____________)

6. How helpful to you were each of the following in learning the subject matter of this course?

	$\overline{X}$		Not at all Helpful				Very Helpful	Didn't Use/ Doesn't Apply
(14)	3.4	a. videodiscs	1	2	3	4	5	( )
	3.1	b. lab manual	1	2	3	4	5	( )
	3.1	c. textbook or reading list	1	2	3	4	5	( )
	3.0	d. lectures	1	2	3	4	5	( )
	3.4	e. laboratory sessions	1	2	3	4	5	( )
	3.2	f. teaching assistant or lab assistant	1	2	3	4	5	( )
	3.2	g. section meetings	1	2	3	4	5	( )
	2.2	h. lab reports	1	2	3	4	5	( )
(22)		i. other (please describe)	1	2	3	4	5	( )

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: Emporia Course: Biology

Date: ______ Climate & Life (N ≃ 40)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

10% (1) undeclared
___ (2) engineering
5% (3) physical sciences
46% (4) biological sciences
3% (5) social sciences
3% (6) humanities
33% (7) other (describe): ______

(5) 2. What is your approximate grade point average (GPA) at this school?

15% (1) 3.5-4.0
21% (2) 3.0-3.4
8% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
56% (7) no GPA yet

(6) 3. What is your gender?

35% (1) male
65% (2) female

(7) 4. Is English your first language?

98% (1) yes
(8) 2% (2) no (what is your first language? ______)

5. Prior to this videodisc how would you rate your skills in

	x̄		Not at all skilled				Very skilled
(9)	1.5	a. using microcomputers?	1	2	3	4	5
	1.5	b. using videodisc players?	1	2	3	4	5
(11)	2.9	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 63%	2 37%	3
	b. perform or view another lab experiment on this same topic?	1 98%	2 2%	3
(14)	c. perform this lab before?	1 100%	2	3

(15) 7. How many separate sessions did you view this videodisc?

98% (1) one
2% (2) two
___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

(0-180)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 24$

(19-21) b. actually working on the videodisc? $\bar{x} = 104$ (0-220)

(22-24) c. outside of lab writing up a report? $\bar{x} = 0$

(25) 9. The amount of time you were allowed for viewing this disc was

8% (1) too much (more than necessary)
18% (2) too little (How much more time was needed? ________________)
75% (3) about right

(26) 10. For this lab videodisc, did you work

98% (1) alone
2% (2) with one other person
____ (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100% (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

		Not an important reason				A very important reason
(28)	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	b. because another student recommended it	1	2	3	4	5
	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d. to learn more about the subject matter	1	2	3	4	5
	e. to do better on the exams or tests	1	2	3	4	5
	f. in order to obtain extra credit	1	2	3	4	5
	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.0	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	2.9	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$			Not at all effective				Very effective	Don't know
(38)	2.5	a.	understand calculations?	1	2	3	4	5	( )
	2.7	b.	understand results?	1	2	3	4	5	( )
(40)	3.0	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$			Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	3.3	a.	using the hardware	1	2	3	4	5	( )
	3.1	b.	conducting the experiment	1	2	3	4	5	( )
	2.6	c.	reporting results of your experiment	1	2	3	4	5	( )
(44)	3.6	d.	following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

69%(1) no
31%(2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.2	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	2.8	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.1	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.6	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.1	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.4	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.6	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.8	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.6	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

	$\bar{x}$	20. (Con.)	Strongly disagree				Strongly agree	Don' know, Doesn' appl
(55)	2.6	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.2	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.4	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.2	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.3	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.2	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.2	c. using the keyboard?	1	2	3	4	5	( )
(62)	2.0	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective				Very effective	Don't know
(63)	4.1	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.9	b. instructions on the videodisc	1	2	3	4	5	( )
	3.9	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.4	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.6	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.6	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.1	g. explanations	1	2	3	4	5	( )
	3.1	h. quizzes	1	2	3	4	5	( )
	4.1	i. visual images and action (content)	1	2	3	4	5	( )
	4.2	j. quality of the sound	1	2	3	4	5	( )
	4.2	k. quality of the video screen picture	1	2	3	4	5	( )
	3.9	l. readibility of the text on the screen	1	2	3	4	5	( )
	3.8	m. overall production quality	1	2	3	4	5	( )
(76)		n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	2.9	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.1	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

98% (1) 0
2% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: Emporia
(3-4) Date: ______
Course: Bio
Title of Lab Session: Climate & Life
CN ≃ 44 students.

(5) 1. What is the general area of your major?

16% (1) undeclared
2% (2) engineering
2% (3) physical sciences
44% (4) biological sciences
-5 (5) social sciences
5% (6) humanities
36% (7) other (describe: ______)

(6) 2. What is your approximate grade point average (GPA) at this school?

7% (1) 3.5-4.0
16% (2) 3.0-3.4
7% (3) 2.5-2.9
6% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
64% (7) no GPA yet

(7) 3. What is your gender?

41% (1) male
59% (2) female

(8) 4. Is English your first language?

100% (1) yes
(9) ___ (2) no (what is your first language? ______)

5. how would you rate your skills in:

	$\bar{X}$		Not at all skilled				Very skilled
(10)	1.9	a. using microcomputers?	1	2	3	4	5
	1.8	b. using videodisc players?	1	2	3	4	5
(12)	3.2	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 43%	2 43%	3 14%
	b. perform another lab on this same topic?	1 74%	2 12%	3 14%
(15)	c. perform this lab before?	1 86%	2 2%	3 12%

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{X} = 14$ (0-80)
(19-21) b. in this lab session working on the experiment? $\bar{X} = 98$ (45-180 mins)
(22-24) c. outside of lab writing up the report? $\bar{X} = 32$ (0-150 min)

(25) 8. The amount of time alloted for this lab session was:

5% (1) too much (more than necessary)
43% (2) too little (How much more time was needed? ______)
52% (3) about right

(26) 9. For this lab session, did you work:

34% (1) alone
42% (2) with one other person
8% (3) with two other people
16% (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same		Higher	Don't kn
(27)	3.2	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.2	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't kn Doesn't app
(29)	2.8	a. understand calculations?	1	2	3	4	5	( )
	3.1	b. understand results?	1	2	3	4	5	( )
(31)	3.3	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't kn Doesn't app
(32)	3.7	a. using the equipment?	1	2	3	4	5	( )
	3.7	b. following instructions?	1	2	3	4	5	( )
	3.2	c. conducting the experiment?	1	2	3	4	5	( )
(35)	3.0	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carryi out the experiment?

85% (1) no
15% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don kno
(37)	2.9	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	(
	3.3	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	(
	2.6	c.	I was bored most of the time in this lab session.	1	2	3	4	5	(
	2.6	d.	I was confused most of the time in this lab session.	1	2	3	4	5	(
	2.7	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	(
	3.0	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	(
	2.2	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	(
(44)	3.3	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	(

(45) 18. Did you view a videodisc on the topic of this lab?
90%(1) no
10%(2) yes
____(3) don't remember

Thank you for your comments.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ____________ Course: Berkeley Respiration

Date: ____________ Summer '83 (N≃6 students)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration	___ (2) Chemistry: Unknowns
X (3) Biology: Respiration	___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion	___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major? (N=6)

17% (1) undeclared	16% (4) biological sciences
17% (2) engineering	16% (5) social sciences
33% (3) physical sciences	___ (6) humanities
	___ (7) other (describe): ____________

(5) 2. What is your approximate grade point average (GPA) at this school? (N=6)

17% (1) 3.5-4.0	___ (4) 2.0-2.4
66% (2) 3.0-3.4	___ (5) 1.5-1.9
17% (3) 2.5-2.9	___ (6) below 1.5
	___ (7) no GPA yet

(6) 3. What is your gender? (N=6)

67% (1) male
33% (2) female

(7) 4. Is English your first language?

83% (1) yes
(8) 17% (2) no (what is your first language? code 1 ____________)

5. Prior to this videodisc how would you rate your skills in (N=6)

		Not at all skilled				Very skilled	$\bar{x}$
(9)	a. using microcomputers?	1 50%	2 17%	3 17%	4 17%	5 –	2.0
	b. using videodisc players?	1 67%	2 17%	3 –	4 17%	5 –	1.7
(11)	c. typing?	1 17%	2 17%	3 17%	4 17%	5 33%	3.3

6. Prior to this lab session, did you (N=5)

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 60%	2 40%	3
	b. perform or view another lab experiment on this same topic?	1 83%	2 17%	3
(14)	c. perform this lab before?	1 100%	2	3

(15) 7. How many separate sessions did you view this videodisc? (N=5)

100% (1) one ___ (2) two ___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (N= 5)

(16-18) a. in preparation before you actually began working on the videodisc lab? 2
(19-21) b. actually working on the videodisc? 86 (40 - 120)
(22-24) c. outside of lab writing up a report? —

(25) 9. The amount of time you were allowed for viewing this disc was (N=5)

20% (1) too much (more than necessary)
- (2) too little (How much more time was needed? ________________)
80% (3) about right

(26) 10. For this lab videodisc, did you work (N=6)

100% (1) alone
____ (2) with one other person
____ (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc? (N=6)

____ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc): (N=6)

	$\bar{x}$		Not an important reason				A very important reason
(28)	2.7	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.6	b. because another student recommended it	1	2	3	4	5
	1.0	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	2.0	d. to learn more about the subject matter	1	2	3	4	5
	1.2	e. to do better on the exams or tests	1	2	3	4	5
	4.7	f. in order to obtain extra credit	1	2	3	4	5
	1.0	g. as a substitute for another assignment or test	1	2	3	4	5
35)	3.2	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your (N=6)

	$\bar{x}$		Lower		Same		Higher	Don't Know
36)	3.5	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
37)	3.6	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.2	a. understand calculations?	1	2	3	4	5	( )
	3.0	b. understand results?	1	2	3	4	5	( )
(40)	2.7	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel (N = 6)

			Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	3.8	a. using the hardware	1	2	3	4	5	( )
	3.8	b. conducting the experiment	1	2	3	4	5	( )
	3.3	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	3.2	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment? (N = 6)

50% (1) no
50% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements (N = 6)

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	2.8	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.0	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.3	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.5	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.5	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.2	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.7	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.0	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
54)	2.3	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

			Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	2.3	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.3	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.8	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.7	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems (N=6)

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
59)	2.0	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.8	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.7	c. using the keyboard?	1	2	3	4	5	( )
62)	1.8	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features (N=6)

	$\bar{x}$		Not at all effective				Very effective	Don't know
53)	4.2	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.0	b. instructions on the videodisc	1	2	3	4	5	( )
	3.8	c. opportunities to work at own pace	1	2	3	4	5	( )
	2.8	d. opportunities for feedback on answers	1	2	3	4	5	( )
	2.8	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.0	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.3	g. explanations	1	2	3	4	5	( )
	3.3	h. quizzes	1	2	3	4	5	( )
	3.3	i. visual images and action (content)	1	2	3	4	5	( )
	3.5	j. quality of the sound	1	2	3	4	5	( )
	4.3	k. quality of the video screen picture	1	2	3	4	5	( )
	4.4	l. readibility of the text on the screen	1	2	3	4	5	( )
	2.5	m. overall production quality	1	2	3	4	5	( )
6)	2.8	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the (N=6)

7)	3.0	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.2	b. amount of new information:	too little	1	2	3	4	5	too much
9)	2.5	c. level of information:	too elementary	1	2	3	4	5	too advanced

0) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course? (N=6)

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

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Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ______ Course: Berkeley Respiration F '83 (N ≈ 39 students)

Date: ______

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

22% (1) undeclared
11% (2) engineering
___ (3) physical sciences
51% (4) biological sciences
5% (5) social sciences
3% (6) humanities
8% (7) other (describe): ______

(5) 2. What is your approximate grade point average (GPA) at this school?

14% (1) 3.5-4.0
42% (2) 3.0-3.4
39% (3) 2.5-2.9
6% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
___ (7) no GPA yet

(6) 3. What is your gender?

49% (1) male
51% (2) female

(7) 4. Is English your first language?

83% (1) yes
(8) 17% (2) no (what is your first language? ______)

5. Prior to this videodisc how would you rate your skills in

	$\bar{X}$		Not at all skilled				Very skilled
(9)	2.0	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
(11)	3.3	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

	$\bar{X}$		No	Yes	Don't Remember
(12)	1.7	a. study this same topic in another course?	1 30%	2 67%	3 3%
	1.8	b. perform or view another lab experiment on this same topic?	1 15%	2 85%	3
(14)	1.9	c. perform this lab before?	1 14%	2 86%	3

(15) 7. How many separate sessions did you view this videodisc?

97% (1) one
3% (2) two
___ (3) three or more (How many? ______

8. In minutes, approximately how much time did you spend

(0-20 minutes

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$ = 4

(19-21) b. actually working on the videodisc? $\bar{x}$ = 38 (5-113 minutes)

(22-24) c. outside of lab writing up a report? $\bar{x}$ = 7 (0-22 minutes)

(25) 9. The amount of time you were allowed for viewing this disc was

13% (1) too much (more than necessary)
8% (2) too little (How much more time was needed? ______________)
62% (3) about right

(26) 10. For this lab videodisc, did you work

21% (1) alone
28% (2) with one other person
31% (3) with two other people
20% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

___ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$			Not an important reason				A very important reason
(28)	2.1	a.	because the professor or teaching assistant recommended it	1	2	3	4	5
	1.9	b.	because another student recommended it	1	2	3	4	5
	1.6	c.	to get additional help in an area in which I am having difficulties	1	2	3	4	5
	2.9	d.	to learn more about the subject matter	1	2	3	4	5
	2.1	e.	to do better on the exams or tests	1	2	3	4	5
	1.2	f.	in order to obtain extra credit	1	2	3	4	5
	1.7	g.	as a substitute for another assignment or test	1	2	3	4	5
(35)	3.9	h.	to see what videodiscs are all about	1	2	3	4	5
		i.	other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$			Lower		Same		Higher	Don't Know
(36)	3.2	a.	level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.2	b.	interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.9	a. understand calculations?	1	2	3	4	5	( )
	3.5	b. understand results?	1	2	3	4	5	( )
(40)	3.9	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't app
(41)	3.8	a. using the hardware	1	2	3	4	5	( )
	3.6	b. conducting the experiment	1	2	3	4	5	( )
	3.5	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.0	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

72% (1) no

28% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn' apply
(46)	3.6	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.8	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.2	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	1.7	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.2	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.7	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.9	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.8	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.5	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

			Strongly disagree				Strongly agree	Don' kno Doesn app
(55)	3.4	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	2.9	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.2	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.9	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{X}$		No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.3	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.0	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.2	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{X}$		Not at all effective				Very effective	Don' know
(63)	4.2	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	4.1	b. instructions on the videodisc	1	2	3	4	5	( )
	4.6	c. opportunities to work at own pace	1	2	3	4	5	( )
	4.1	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.8	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.9	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	4.1	g. explanations	1	2	3	4	5	( )
	3.7	h. quizzes	1	2	3	4	5	( )
	3.2	i. visual images and action (content)	1	2	3	4	5	( )
	3.8	j. quality of the sound	1	2	3	4	5	( )
	3.3	k. quality of the video screen picture	1	2	3	4	5	( )
	3.9	l. readibility of the text on the screen	1	2	3	4	5	( )
	2.9	m. overall production quality	1	2	3	4	5	( )
(76)	3.6	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{X}$								
(77)	2.5	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.6	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.6	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

97% (1) 0
3% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: UC Berkeley Course: Bio 1
(3-4) Date: ____________ Title of Lab Session: Respiration

(N ≃ 10 students

(5) 1. What is the general area of your major?

30% (1) undeclared
10% (2) engineering
___ (3) physical sciences
50% (4) biological sciences
___ (5) social sciences
___ (6) humanities
10% (7) other (describe: ____________)

(6) 2. What is your approximate grade point average (GPA) at this school?

10% (1) 3.5-4.0
50% (2) 3.0-3.4
10% (3) 2.5-2.9
30% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
___ (7) no GPA yet

(7) 3. What is your gender?

60% (1) male
40% (2) female

(8) 4. Is English your first language?

90% (1) yes
(9) 10% (2) no (what is your first language? ____________)

5. how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
(10)	2.1	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
(12)	2.9	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 80%	2 10%	3 10%
	b. perform another lab on this same topic?	1 90%	2	3 10%
(15)	c. perform this lab before?	1 100%	2	3

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x}$ = 25 (15-30 mins)
(19-21) b. in this lab session working on the experiment? $\bar{x}$ = 118 (60-180 mins)
(22-24) c. outside of lab writing up the report? $\bar{x}$ = 63 (20-90 mins)

(25) 8. The amount of time alloted for this lab session was:

___ (1) too much (more than necessary)
10% (2) too little (How much more time was needed? ________)
90% (3) about right

(26) 9. For this lab session, did you work:

____ (1) alone
10% (2) with one other person
10% (3) with two other people
80% (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{X}$		Lower		Same		Higher	Don't kn
(27)	2.8	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.3	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{X}$		Not at all effective				Very effective	Don't kn Doesn't app
(29)	2.9	a. understand calculations?	1	2	3	4	5	( )
	3.7	b. understand results?	1	2	3	4	5	( )
(31)	3.6	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{X}$		Not at all confident				Very confident	Don't kn Doesn't app
(32)	3.5	a. using the equipment?	1	2	3	4	5	( )
	3.9	b. following instructions?	1	2	3	4	5	( )
	3.8	c. conducting the experiment?	1	2	3	4	5	( )
(35)	4.4	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carryi out the experiment?

100% (1) no
____ (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{X}$		Strongly disagree				Strongly agree	Don kno
(37)	3.8	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	(
	3.8	b. In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	(
	2.5	c. I was bored most of the time in this lab session.	1	2	3	4	5	(
	1.7	d. I was confused most of the time in this lab session.	1	2	3	4	5	(
	2.4	e. My interest in science has increased because of this lab session.	1	2	3	4	5	(
	3.0	f. I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	(
	2.1	g. I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	(
(44)	2.9	h. I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	(

(45) 18. Did you view a videodisc on the topic of this lab?

100%(1) no
____(2) yes
____(3) don't remember

Thank you for your comments.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ____________ Course: Nebraska

Respiration
Fall 83
(N ≈ 21 students)

Date: ____________

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
✓ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

43% (1) undeclared
10% (2) engineering
5% (3) physical sciences
___ (4) biological sciences
5% (5) social sciences
___ (6) humanities
38% (7) other (describe): ____________

(5) 2. What is your approximate grade point average (GPA) at this school?

15% (1) 3.5-4.0
45% (2) 3.0-3.4
15% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
25% (7) no GPA yet

(6) 3. What is your gender?

43% (1) male
57% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ____________)

5. Prior to this videodisc, how would you rate your skills in

	X̄		Not at all skilled				Very skilled
(9)	3.0	a. using microcomputers?	1	2	3	4	5
	2.8	b. using videodisc players?	1	2	3	4	5
(11)	3.5	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 43%	2 19%	3 38%
	b. perform or view another lab experiment on this same topic?	1 81%	2 9%	3 10%
(14)	c. perform this lab before?	1 95%	2	3 5%

(15) 7. How many separate sessions did you view this videodisc?

91% (1) one
9% (2) two
___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

(5-30min)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$ = 12

(19-21) b. actually working on the videodisc? $\bar{x}$ 98 (60-150 mins)

(22-24) c. outside of lab writing up a report? $\bar{x}$ = 42 (15-90 mins)

(25) 9. The amount of time you were allowed for viewing this disc was

10% (1) too much (more than necessary)
5% (2) too little (How much more time was needed? ________________)
85% (3) about right

(26) 10. For this lab videodisc, did you work

20% (1) alone
20% (2) with one other person
5% (3) with two other people
55% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100% (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

		Not an important reason				A very important reason
(28)	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	b. because another student recommended it	1	2	3	4	5
	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d. to learn more about the subject matter	1	2	3	4	5
	e. to do better on the exams or tests	1	2	3	4	5
	f. in order to obtain extra credit	1	2	3	4	5
	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.8	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.6	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	3.5	a. understand calculations?	1	2	3	4	5	( )
	3.9	b. understand results?	1	2	3	4	5	( )
(40)	4.0	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't app
(41)	4.1	a. using the hardware	1	2	3	4	5	( )
	4.2	b. conducting the experiment	1	2	3	4	5	( )
	4.1	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.2	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

86% (1) no

14% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn' apply
(46)	4.0	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.9	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.4	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	1.8	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	1.9	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.8	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.2	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	2.2	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

		20. (Con.)	Strongly disagree				Strongly agree	Don kno Doesn app
	x̄							
(55)	4.3	j. I would like more labs on videodisc.	1	2	3	4	5	(
	2.5	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	(
	2.7	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	(
(58)	3.0	m. This videodisc had too much text, too much to read.	1	2	3	4	5	(

21. Did you have any problems

	x̄		No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.2	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.2	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.5	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	x̄		Not at all effective				Very effective	Don' know
(63)	3.8	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	4.2	b. instructions on the videodisc	1	2	3	4	5	( )
	3.9	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.8	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.5	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.3	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.5	g. explanations	1	2	3	4	5	( )
	3.6	h. quizzes	1	2	3	4	5	( )
	3 9	i. visual images and action (content)	1	2	3	4	5	( )
	3.9	j. quality of the sound	1	2	3	4	5	( )
	4.2	k. quality of the video screen picture	1	2	3	4	5	( )
	4.0	l. readibility of the text on the screen	1	2	3	4	5	( )
	4.0	m. overall production quality	1	2	3	4	5	( )
(76)	3.6	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	x̄								
(77)	3.0	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.2	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

5% (1) 0
95% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: Nebraska Course: Biology
Respiration

Date: ____________________

(N ≃ 37)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
✓ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

33% (1) undeclared
6% (2) engineering
11% (3) physical sciences
6% (4) biological sciences
3% (5) social sciences
3% (6) humanities
39% (7) other (describe): ____________________

(5) 2. What is your approximate grade point average (GPA) at this school?

25% (1) 3.5-4.0
33% (2) 3.0-3.4
11% (3) 2.5-2.9
6% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
25% (7) no GPA yet

(6) 3. What is your gender?

43% (1) male
57% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ____________________)

5. Prior to this videodisc ho would you rate your skills in

	$\overline{x}$		Not at all skilled				Very skilled
(9)	2.7	a. using microcomputers?	1	2	3	4	5
	2.9	b. using videodisc players?	1	2	3	4	5
(11)	3.6	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 46%	2 27%	3 27%
	b. perform or view another lab experiment on this same topic?	1 81%	2 11%	3 8%
(14)	c. perform this lab before?	1 97%	2 3%	3

(15) 7. How many separate sessions did you view this videodisc?

81% (1) one
19% (2) two
___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (0-30)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$ = 12
(19-21) b. actually working on the videodisc? $\bar{x}$ = 102 (21-180)
(22-24) c. outside of lab writing up a report? $\bar{x}$ = 43 (0-105)

(25) 9. The amount of time you were allowed for viewing this disc was

11% (1) too much (more than necessary)
8% (2) too little (How much more time was needed? ________________)
81% (3) about right

(26) 10. For this lab videodisc, did you work

22% (1) alone
19% (2) with one other person
17% (3) with two other people
42% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100% (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

		Not an important reason				A very important reason
(28)	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	b. because another student recommended it	1	2	3	4	5
	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d. to learn more about the subject matter	1	2	3	4	5
	e. to do better on the exams or tests	1	2	3	4	5
	f. in order to obtain extra credit	1	2	3	4	5
	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.8	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.6	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	3.5	a. understand calculations?	1	2	3	4	5	( )
	3.7	b. understand results?	1	2	3	4	5	( )
(40)	3.9	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	4.1	a. using the hardware	1	2	3	4	5	( )
	3.9	b. conducting the experiment	1	2	3	4	5	( )
	3.9	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.3	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

84% (1) no
16% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.9	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.9	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.7	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.0	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.0	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.7	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.2	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	2.4	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

	$\bar{x}$			Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	4.1	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	2.5	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.1	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.8	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.2	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.3	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.1	c.	using the keyboard?	1	2	3	4	5	( )
(62)	1.4	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don't know
(63)	3.9	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.9	b.	instructions on the videodisc	1	2	3	4	5	( )
	3.9	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3.8	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.3	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.2	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.5	g.	explanations	1	2	3	4	5	( )
	2.5	h.	quizzes	1	2	3	4	5	( )
	3.8	i.	visual images and action (content)	1	2	3	4	5	( )
	3.8	j.	quality of the sound	1	2	3	4	5	( )
	4.0	k.	quality of the video screen picture	1	2	3	4	5	( )
	3.9	l.	readibility of the text on the screen	1	2	3	4	5	( )
	3.9	m.	overall production quality	1	2	3	4	5	( )
(76)	3.5	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	3.0	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.1	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

6% (1) 0
94% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: Nebraska Course: Bio 1
(3-4) Date: ______ Title of Lab Session: Respiration

N = 32

(5) 1. What is the general area of your major?

22% (1) undeclared
3% (2) engineering
9% (3) physical sciences
6% (4) biological sciences
6% (5) social sciences
___ (6) humanities
53% (7) other (describe: ______)

(6) 2. What is your approximate grade point average (GPA) at this school?

10% (1) 3.5-4.0
32% (2) 3.0-3.4
32% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
26% (7) no GPA yet

(7) 3. What is your gender?

34% (1) male
66% (2) female

(8) 4. Is English your first language?

100% (1) yes
(9) ___ (2) no (what is your first language? ______)

5. how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
(10)	1.9	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
(12)	3.3	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 59%	2 34%	3 7%
	b. perform another lab on this same topic?	1 88%	2 6%	3 6%
(15)	c. perform this lab before?	1 91%	2 6%	3 3%

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x}$ = 44.5 (range 5-180)
(19-21) b. in this lab session working on the experiment? $\bar{x}$ = 123 (range 60-180)
(22-24) c. outside of lab writing up the report? $\bar{x}$ = 39 (range 0-180)

(25) 8. The amount of time alloted for this lab session was:

3% (1) too much (more than necessary)
28% (2) too little (How much more time was needed? ______)
69% (3) about right

(26) 9. For this lab session, did you work:

____ (1) alone
13% (2) with one other person
19% (3) with two other people
68% (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same		Higher	Don't kn
(27)	3.2	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.5	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't kn Doesn't app
(29)	2.7	a. understand calculations?	1	2	3	4	5	( )
	3.4	b. understand results?	1	2	3	4	5	( )
(31)	3.2	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't kn Doesn't app
(32)	3.6	a. using the equipment?	1	2	3	4	5	( )
	3.5	b. following instructions?	1	2	3	4	5	( )
	3.4	c. conducting the experiment?	1	2	3	4	5	( )
(35)	3.2	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carryi out the experiment?

88% (1) no
12% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don kno
(37)	3.3	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	(
	3.4	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	(
	2.6	c.	I was bored most of the time in this lab session.	1	2	3	4	5	(
	2.8	d.	I was confused most of the time in this lab session.	1	2	3	4	5	(
	2.2	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	(
	3.4	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	(
	2.3	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	(
(44)	29	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	(

(45) 18. Did you view a videodisc on the topic of this lab?
97% (1) no
3% (2) yes
____(3) don't remember

Thank you for your comments.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ____________ Course: Emporia
Respiration
Fall '83
(N ≃ 36 students)

Date: ____________

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

12% (1) undeclared
___ (2) engineering
3% (3) physical sciences
54% (4) biological sciences
3% (5) social sciences
3% (6) humanities
24% (7) other (describe): ____________

(5) 2. What is your approximate grade point average (GPA) at this school?

17% (1) 3.5-4.0
28% (2) 3.0-3.4
17% (3) 2.5-2.9
8% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
31% (7) no GPA yet

(6) 3. What is your gender?

28% (1) male
72% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ____________)

5. Prior to this videodisc, how would you rate your skills in

	$\bar{x}$			Not at all skilled				Very skilled
(9)	1.9	a.	using microcomputers?	1	2	3	4	5
	2.2	b.	using videodisc players?	1	2	3	4	5
(11)	2.9	c.	typing?	1	2	3	4	5

6. Prior to this lab session, did you

			No	Yes	Don't Remember
(12)	a.	study this same topic in another course?	1 61%	2 36%	3 3%
	b.	perform or view another lab experiment on this same topic?	1 89%	2 11%	3
(14)	c.	perform this lab before?	1 97%	2 3%	3

(15) 7. How many separate sessions did you view this videodisc?

100% (1) one
___ (2) two
___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 4$ (0-30 mi
(19-21) b. actually working on the videodisc? $\bar{x} = 81$ (10-129 mins)
(22-24) c. outside of lab writing up a report? $\bar{x} = 13$ (0-60 mins)

(25) 9. The amount of time you were allowed for viewing this disc was

23 % (1) too much (more than necessary)
3 % (2) too little (How much more time was needed? ________________)
74 % (3) about right

(26) 10. For this lab videodisc, did you work

94 % (1) alone
6 % (2) with one other person
____ (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100 % (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

		Not an important reason				A very important reason
(28)	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	b. because another student recommended it	1	2	3	4	5
	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d. to learn more about the subject matter	1	2	3	4	5
	e. to do better on the exams or tests	1	2	3	4	5
	f. in order to obtain extra credit	1	2	3	4	5
	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.4	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.2	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$			Not at all effective				Very effective	Don't know
(38)	2.5	a.	understand calculations?	1	2	3	4	5	( )
	3.3	b.	understand results?	1	2	3	4	5	( )
(40)	3.3	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$			Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	3.9	a.	using the hardware	1	2	3	4	5	( )
	3.4	b.	conducting the experiment	1	2	3	4	5	( )
	3.4	c.	reporting results of your experiment	1	2	3	4	5	( )
(44)	3.7	d.	following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

97% (1) no
3% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.2	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.5	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.4	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.6	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.4	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.5	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.3	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.7	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.4	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

		20. (Con.)	Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(55)	2.7	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.4	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	2.9	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.9	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.3	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.2	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.5	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective				Very effective	Don't know
(63)	3.5	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.5	b. instructions on the videodisc	1	2	3	4	5	( )
	3.8	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.2	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.0	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.3	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.9	g. explanations	1	2	3	4	5	( )
	3.4	h. quizzes	1	2	3	4	5	( )
	3.5	i. visual images and action (content)	1	2	3	4	5	( )
	3.9	j. quality of the sound	1	2	3	4	5	( )
	3.9	k. quality of the video screen picture	1	2	3	4	5	( )
	3.9	l. readibility of the text on the screen	1	2	3	4	5	( )
	3.7	m. overall production quality	1	2	3	4	5	( )
(76)	3.4	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	2.7	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.7	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

6% (1) 0
94% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ______________ Course: Emporia (GB 584)
Respiration
Fall '83
(N = 17)

Date: ______________

(3) Title of videodisc (check one):

____ (1) Chemistry: Titration
____ (2) Chemistry: Unknowns
____ (3) Biology: Respiration
____ (4) Biology: Climate and Life
____ (5) Physics: Physics of Motion
____ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

____ (1) undeclared
____ (2) engineering
6% (3) physical sciences
88% (4) biological sciences
____ (5) social sciences
____ (6) humanities
6% (7) other (describe): ______________

(5) 2. What is your approximate grade point average (GPA) at this school?

41% (1) 3.5-4.0
29% (2) 3.0-3.4
24% (3) 2.5-2.9
6% (4) 2.0-2.4
____ (5) 1.5-1.9
____ (6) below 1.5
____ (7) no GPA yet

(6) 3. What is your gender?

59% (1) male
41% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ____ (2) no (what is your first language? ______________)

5. Prior to this videodisc how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	1.8	a. using microcomput rs?	1	2	3	4	5
	1.2	b. using videodisc players?	1	2	3	4	5
(11)	2.6	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 12%	2 88%	3
	b. perform or view another lab experiment on this same topic?	1 35%	2 65%	3
(14)	c. perform this lab before?	1 82%	2 18%	3

(15) 7. How many separate sessions did you view this videodisc?

82% (1) one
6% (2) two
12% (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$, 9 (0-10)
(19-21) b. actually working on the videodisc? $\bar{x}$: 57 (30-120 minutes)
(22-24) c. outside of lab writing up a report? $\bar{x}$: 4 (0-30)

(25) 9. The amount of time you were allowed for viewing this disc was

13% (1) too much (more than necessary)
7% (2) too little (How much more time was needed? ________________)
80% (3) about right

(26) 10. For this lab videodisc, did you work

35% (1) alone
6% (2) with one other person
53% (3) with two other people
6% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100% (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

		Not an important reason				A very important reason
(28)	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	b. because another student recommended it	1	2	3	4	5
	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d. to learn more about the subject matter	1	2	3	4	5
	e. to do better on the exams or tests	1	2	3	4	5
	f. in order to obtain extra credit	1	2	3	4	5
	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.2	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.5	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.6	a. understand calculations?	1	2	3	4	5	( )
	3.5	b. understand results?	1	2	3	4	5	( )
(40)	2.4	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't app
(41)	3.2	a. using the hardware	1	2	3	4	5	( )
	3.8	b. conducting the experiment	1	2	3	4	5	( )
	3.8	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.2	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

88% (1) no
12% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.6	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.4	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.7	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.1	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.2	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	4.4	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.2	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.9	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	4.5	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

	$\bar{x}$			Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	2.6	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	2.5	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.2	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.3	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.0	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.2	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.2	c.	using the keyboard?	1	2	3	4	5	( )
(62)	1.7	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don' know
(63)	3.7	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.7	b.	instructions on the videodisc	1	2	3	4	5	( )
	3.8	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3.6	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.1	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.3	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.6	g.	explanations	1	2	3	4	5	( )
	3.5	h.	quizzes	1	2	3	4	5	( )
	3.5	i.	visual images and action (content)	1	2	3	4	5	( )
	4.1	j.	quality of the sound	1	2	3	4	5	( )
	4.2	k.	quality of the video screen picture	1	2	3	4	5	( )
	3.8	l.	readibility of the text on the screen	1	2	3	4	5	( )
	3.9	m.	overall production quality	1	2	3	4	5	( )
(76)	3.5	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	2.9	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.7	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

92% (1) 0
16% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: Emporia Course: ____________

(3-4) Date: ____________ Title of Lab Session: Respiration

(N ≃ 37 students)

(5) 1. What is the general area of your major?

17% (1) undeclared
___ (2) engineering
3% (3) physical sciences
42% (4) biological sciences
3% (5) social sciences
6% (6) humanities
31% (7) other (describe: ____________)

(6) 2. What is your approximate grade point average (GPA) at this school?

11% (1) 3.5-4.0
16% (2) 3.0-3.4
32% (3) 2.5-2.9
14% (4) 2.0-2.4
5% (5) 1.5-1.9
3% (6) below 1.5
19% (7) no GPA yet

(7) 3. What is your gender?

46% (1) male
54% (2) female

(8) 4. Is English your first language?

97% (1) yes

(9) 3% (2) no (what is your first language? ____________)

5. how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
(10)	2.1	a. using microcomputers?	1	2	3	4	5
	2.0	b. using videodisc players?	1	2	3	4	5
(12)	3.3	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 43%	2 49%	3 8%
	b. perform another lab on this same topic?	1 76%	2 14%	3 10%
(15)	c. perform this lab before?	1 92%	2 3%	3 5%

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x} = 16$ (0-120 mi

(19-21) b. in this lab session working on the experiment? $\bar{x} = 71$ (10-180)

(22-24) c. outside of lab writing up the report? $\bar{x} = 10$ (0-90)

(25) 8. The amount of time alloted for this lab session was:

14% (1) too much (more than necessary)
3% (2) too little (How much more time was needed? ________)
83% (3) about right

(26) 9. For this lab session, did you work:

27% (1) alone
46% (2) with one other person
19% (3) with two other people
8% (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same		Higher	Don't kn
(27)	3.3	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.3	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't kn Doesn't app
(29)	2.7	a. understand calculations?	1	2	3	4	5	( )
	3.3	b. understand results?	1	2	3	4	5	( )
(31)	3.4	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't kn Doesn't app
(32)	4.0	a. using the equipment?	1	2	3	4	5	( )
	3.7	b. following instructions?	1	2	3	4	5	( )
	3.8	c. conducting the experiment?	1	2	3	4	5	( )
(35)	3.4	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carryi out the experiment?

95% (1) no
5% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{X}$		Strongly disagree				Strongly agree	Don knc
(37)	3.4	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	(
	3.6	b. In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	(
	2.8	c. I was bored most of the time in this lab session.	1	2	3	4	5	(
	2.4	d. I was confused most of the time in this lab session.	1	2	3	4	5	(
	2.8	e. My interest in science has increased because of this lab session.	1	2	3	4	5	(
	3.1	f. I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	(
	2.0	g. I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	(
(44)	2.9	h. I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	(

(45) 18. Did you view a videodisc on the topic of this lab?

97%(1) no
3%(2) yes
____(3) don't remember

Thank you for your comments.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ______________ Course: Wisconsin

Date: ______________ Titration
Summer '83
(N=6 students)

(3) Title of videodisc (check one):

✓ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major? (N=6)

33% (1) undeclared
___ (2) engineering
___ (3) physical sciences
50% (4) biological sciences
___ (5) social sciences
___ (6) humanities
17% (7) other (describe): ______________

(5) 2. What is your approximate grade point average (GPA) at this school? (N=6)

50% (1) 3.5-4.0
___ (2) 3.0-3.4
___ (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
50% (7) no GPA yet

(6) 3. What is your gender? (N=6)

33% (1) male
67% (2) female

(7) 4. Is English your first language? code 1 3 1 each

67% (1) yes
(8) 33% (2) no (what is your first language? ______________)

5. Prior to this videodisc how would you rate your skills in (N=6)

			Not at all skilled				Very skilled
	$\bar{x}$						
(9)	1.8	a. using microcomputers?	1	2	3	4	5
	1.2	b. using videodisc players?	1	2	3	4	5
(11)	2.3	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you (N=6)

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 67%	2 33%	3
	b. perform or view another lab experiment on this same topic?	1 67%	2 33%	3
(14)	c. perform this lab before?	1 83%	2 17%	3

(15) 7. How many separate sessions did you view this videodisc? (N=6)

83% (1) one
17% (2) two
___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (N=6)

(16-18) a. in preparation before you actually began working on the videodisc lab? 6
(19-21) b. actually working on the videodisc? 54.2 (20-90 min)
(22-24) c. outside of lab writing up a report? -

(25) 9. The amount of time you were allowed for viewing this disc was (N=6)

20% (1) too much (more than necessary)
- (2) too little (How much more time was needed? ________)
80% (3) about right

(26) 10. For this lab videodisc, did you work (N=5)

20% (1) alone
40% (2) with one other person
40% (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

- (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc): (N=5)

	$\bar{X}$		Not an important reason				A very important reason
(28)	4.2	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.2	b. because another student recommended it	1	2	3	4	5
	2.8	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	4.8	d. to learn more about the subject matter	1	2	3	4	5
	4.0	e. to do better on the exams or tests	1	2	3	4	5
	1.0	f. in order to obtain extra credit	1	2	3	4	5
	1.0	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	2.8	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your (N=6)

	$\bar{X}$		Lower		Same		Higher	Don't Know
(36)	4.0	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.8	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you (N=6)

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	3.0	a. understand calculations?	1	2	3	4	5	( )
	3.5	b. understand results?	1	2	3	4	5	( )
(40)	4.5	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel (N=6)

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	3.2	a. using the hardware	1	2	3	4	5	( )
	3.3	b. conducting the experiment	1	2	3	4	5	( )
	3.4	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	3.5	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment? (N=6)

67% (1) no
33% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements (N=6)

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.3	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	4.0	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.5	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.8	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	3.0	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.6	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.3	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.6	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	2.8	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

				Strongly disagree				Strongly agree	Don't know Doesn't appl.
(55)	4.0	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	3.2	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	4.2	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.8	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems (N=5)

	x̄			No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.5	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	2.8	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.7	c.	using the keyboard?	1	2	3	4	5	( )
(62)	2.3	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features (N=6)

	x̄			Not at all effective				Very effective	Don't know
(63)	2.5	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	2.8	b.	instructions on the videodisc	1	2	3	4	5	( )
	4.3	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3.8	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	4.0	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	4.3	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	4.0	g.	explanations	1	2	3	4	5	( )
	4.0	h.	quizzes	1	2	3	4	5	( )
	4.2	i.	visual images and action (content)	1	2	3	4	5	( )
	4.2	j.	quality of the sound	1	2	3	4	5	( )
	4.0	k.	quality of the video screen picture	1	2	3	4	5	( )
	4.0	l.	readibility of the text on the screen	1	2	3	4	5	( )
	4.3	m.	overall production quality	1	2	3	4	5	( )
76)	3.2	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the (N=6)

	x̄									
77)	2.7	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.0	b.	amount of new information:	too little	1	2	3	4	5	too much
79)	3.0	c.	level of information:	too elementary	1	2	3	4	5	too advanced

80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course? (N=6)

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: ______ Course: Wisconsin Titration
(3-4) Date: ______ Title of Lab Session: Summer '83 (N = 7 students)

(5) 1. What is the general area of your major?

11% (1) undeclared
22% (2) engineering
22% (3) physical sciences
11% (4) biological sciences
___ (5) social sciences
___ (6) humanities
33% (7) other (describe: ______)

(6) 2. What is your approximate grade point average (GPA) at this school?

— (1) 3.5-4.0
11% (2) 3.0-3.4
33% (3) 2.5-2.9
33% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
22% (7) no GPA yet

(7) 3. What is your gender?

78% (1) male
22% (2) female

(8) 4. Is English your first language?

100% (1) yes
(9) ___ (2) no (what is your first language? ______)

5. Prior to this lab session, how would you rate your skills in:

	$\bar{X}$		Not at all skilled				Very skilled
(10)	1.7	a. using microcomputers?	1	2	3	4	5
	1.4	b. using videodisc players?	1	2	3	4	5
(12)	3.1	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

			No	Yes	Don't remember
(13)	1.4	a. study this same topic in another course?	1	2	3
	1.4	b. perform another lab on this same topic?	1	2	3
(15)	1.3	c. perform this lab before?	1	2	3

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? 21 (5-60 min)
(19-21) b. in this lab session working on the experiment? 133.3 (60-230)
(22-24) c. outside of lab writing up the report? 65 (30-120)

(25) 8. The amount of time alloted for this lab session was:

22% (1) too much (more than necessary)
11% (2) too little (How much more time was needed? ______)
67% (3) about right

(26) 9. For this lab session, did you work:

100% (1) alone
____ (2) with one other person
____ (3) with two other people
____ (4) with more than two people (How many? _______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same		Higher	Don't kno
(27)	3.3	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.3	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't kno Doesn't appl
(29)	2.4	a. understand calculations?	1	2	3	4	5	( )
	3.1	b. understand results?	1	2	3	4	5	( )
(31)	3.2	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't kno Doesn't appl
(32)	3.4	a. using the equipment?	1	2	3	4	5	( )
	3.6	b. following instructions?	1	2	3	4	5	( )
	3.2	c. conducting the experiment?	1	2	3	4	5	( )
(35)	2.9	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carryin out the experiment?

89% (1) no
11% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\overline{x}$			Strongly disagree				Strongly agree	Don't know
(37)	3.1	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	2.9	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.4	c.	I was bored most of the time in this lab session.	1	2	3	4	5	( )
	2.5	d.	I was confused most of the time in this lab session.	1	2	3	4	5	( )
	2.5	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.3	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	( )
	2.0	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	( )
(44)	3.6	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	( )

Did you use the videodisc

yes 11% (1 person)

how many times

twice

Thank you for your comments.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: Nebraska Course: Chemistry Titration (N≃34)

Date: ________

(3) Title of videodisc (check one):

✓ (1) Chemistry: Titration	___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration	___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion	___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

3% (1) undeclared	75% (4) biological sciences
41% (2) engineering	___ (5) social sciences
50% (3) physical sciences	___ (6) humanities
	25% (7) other (describe): ________

(5) 2. What is your approximate grade point average (GPA) at this school?

21% (1) 3.5-4.0	3% (4) 2.0-2.4
24% (2) 3.0-3.4	___ (5) 1.5-1.9
9% (3) 2.5-2.9	___ (6) below 1.5
	42% (7) no GPA yet

(6) 3. What is your gender?

71% (1) male

29% (2) female

(7) 4. Is English your first language?

97% (1) yes

(8) 3% (2) no (what is your first language? ________)

5. Prior to this videodis how would you rate your skills in

	$\bar{x}$			Not at all skilled				Very skilled
(9)	2.5	a.	using microcomputers?	1	2	3	4	5
	1.8	b.	using videodisc players?	1	2	3	4	5
(11)	3.0	c.	typing?	1	2	3	4	5

6. Prior to this lab session, did you

			No	Yes	Don't Remember
(12)	a.	study this same topic in another course?	1 62%	2 38%	3
	b.	perform or view another lab experiment on this same topic?	1 71%	2 29%	3
(14)	c.	perform this lab before?	1 79%	2 18%	3 3%

(15) 7. How may separate sessions did you view this videodisc?

91% (1) one

___ (2) two

9% (3) three or more (How many? ________)

8. In minutes, approximately how much time did you spend (0-60)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{X} = 8$

(19-21) b. actually working on the videodisc? $x = 50$ (0-120)

(22-24) c. outside of lab writing up a report? $x = 4$ (0 - 20)

(25) 9. The amount of time you were allowed for viewing this disc was

13% (1) too much (more than necessary)
7% (2) too little (How much more time was needed? ______)
81% (3) about right

(26) 10. For this lab videodisc, did you work

36% (1) alone
52% (2) with one other person
12% (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

____ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	3.7	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.7	b. because another student recommended it	1	2	3	4	5
	3.6	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	4.6	d. to learn more about the subject matter	1	2	3	4	5
	4.4	e. to do better on the exams or tests	1	2	3	4	5
	1.4	f. in order to obtain extra credit	1	2	3	4	5
	1.2	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	2.4	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.6	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.5	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$			Not at all effective				Very effective	Don't know
(38)	2.2	a.	understand calculations?	1	2	3	4	5	( )
	3.1	b.	understand results?	1	2	3	4	5	( )
(40)	3.8	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$			Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	3.1	a.	using the hardware	1	2	3	4	5	( )
	3.0	b.	conducting the experiment	1	2	3	4	5	( )
	2.8	c.	reporting results of your experiment	1	2	3	4	5	( )
(44)	3.2	d.	following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

52% (1) no
48% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	2.7	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.3	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.9	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.8	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.7	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.0	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.0	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.2	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

		20. (Con.)		Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	3.8	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	3.3	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.8	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	1.7	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.4	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.7	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.5	c.	using the keyboard?	1	2	3	4	5	( )
(62)	2.3	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don't know
(63)	4.0	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.7	b.	instructions on the videodisc	1	2	3	4	5	( )
	4.5	c.	opportunities to work at own pace	1	2	3	4	5	( )
	2.8	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	4.0	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	4.3	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.8	g.	explanations	1	2	3	4	5	( )
	2.8	h.	quizzes	1	2	3	4	5	( )
	4.0	i.	visual images and action (content)	1	2	3	4	5	( )
	3.9	j.	quality of the sound	1	2	3	4	5	( )
	3.7	k.	quality of the video screen picture	1	2	3	4	5	( )
	4.1	l.	readibility of the text on the screen	1	2	3	4	5	( )
	4.1	m.	overall production quality	1	2	3	4	5	( )
(76)	3.1	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	2.9	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.9	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: UCLA Course: Chemistry Titration (N= 14)

Date: ____

(3) Title of videodisc (check one):

✓ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

7% (1) undeclared
14% (2) engineering
21% (3) physical sciences
57% (4) biological sciences
___ (5) social sciences
___ (6) humanities
___ (7) other (describe): ____

(5) 2. What is your approximate grade point average (GPA) at this school?

7% (1) 3.5-4.0
29% (2) 3.0-3.4
50% (3) 2.5-2.9
14% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
___ (7) no GPA yet

(6) 3. What is your gender?

64% (1) male
36% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ____)

5. Prior to this videodisc how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.4	a. using microcomputers?	1	2	3	4	5
	2.1	b. using videodisc players?	1	2	3	4	5
(11)	3.1	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 79%	2 21%	3
	b. perform or view another lab experiment on this same topic?	1 77%	2 23%	3
(14)	c. perform this lab before?	1 92%	2 8%	3

(15) 7. How may separate sessions did you view this videodisc?

92% (1) one
8% (2) two
___ (3) three or more (How many? ____)

8. In minutes, approximately how much time did you spend

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$ = 7 (0-30)
(19-21) b. actually working on the videodisc? $\bar{x}$ = 26 (0-50)
(22-24) c. outside of lab writing up a report? $\bar{x}$ = 40 (0-120)

(25) 9. The amount of time you were allowed for viewing this disc was

21% (1) too much (more than necessary)
21% (2) too little (How much more time was needed? ________________)
57% (3) about right

(26) 10. For this lab videodisc, did you work

86% (1) alone
14% (2) with one other person
____ (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

7% (1) yes
93% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	2.8	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.5	b. because another student recommended it	1	2	3	4	5
	2.3	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	4.0	d. to learn more about the subject matter	1	2	3	4	5
	3.1	e. to do better on the exams or tests	1	2	3	4	5
	1.5	f. in order to obtain extra credit	1	2	3	4	5
	2.3	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	4.4	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	4.2	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.8	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$			Not at all effective				Very effective	Don't know
(38)	2.6	a.	understand calculations?	1	2	3	4	5	( )
	3.6	b.	understand results?	1	2	3	4	5	( )
(40)	4.0	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$			Not at all confident				Very confident	Don't know/ Doesn't apply
(41)	3.9	a.	using the hardware	1	2	3	4	5	( )
	3.2	b.	conducting the experiment	1	2	3	4	5	( )
	3.2	c.	reporting results of your experiment	1	2	3	4	5	( )
(44)	4.0	d.	following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

79%(1) no

21%(2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	28	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.7	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.7	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	18	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.1	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.1	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.4	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.9	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.3	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(55)	4.1	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	4.3	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.5	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.2	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.4	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.6	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.0	c.	using the keyboard?	1	2	3	4	5	( )
(62)	1.1	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don't know
(63)	3.9	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.6	b.	instructions on the videodisc	1	2	3	4	5	( )
	4.5	c.	opportunities to work at own pace	1	2	3	4	5	( )
	4.2	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	4.1	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	4.2	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.9	g.	explanations	1	2	3	4	5	( )
	4.3	h.	quizzes	1	2	3	4	5	( )
	4.3	i.	visual images and action (content)	1	2	3	4	5	( )
	4.0	j.	quality of the sound	1	2	3	4	5	( )
	3.1	k.	quality of the video screen picture	1	2	3	4	5	( )
	2.5	l.	readibility of the text on the screen	1	2	3	4	5	( )
	4.2	m.	overall production quality	1	2	3	4	5	( )
(76)		n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	3.0	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.2	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	3.1	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT TRADITIONAL LAB SESSION QUESTIONNAIRE

Your responses will help improve these activities. Please respond candidly.

(1-2) Campus: UCLA Course: Chemistry
(3-4) Date: ______ Title of Lab Session: Titration

(5) 1. What is the general area of your major? N ≃ 25)

8% (1) undeclared
25% (2) engineering
17% (3) physical sciences
46% (4) biological sciences
___ (5) social sciences
___ (6) humanities
4% (7) other (describe: ______)

(6) 2. What is your approximate grade point average (GPA) at this school?

8% (1) 3.5-4.0
52% (2) 3.0-3.4
24% (3) 2.5-2.9
12% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
4% (7) no GPA yet

(7) 3. What is your gender?

75% (1) male
25% (2) female

(8) 4. Is English your first language?

76% (1) yes
(9) 24% (2) no (what is your first language? ______)

5. Prior to this lab session, how would you rate your skills in:

	$\bar{x}$		Not at all skilled				Very skilled
(10)	1.9	a. using microcomputers?	1	2	3	4	5
	1.8	b. using videodisc players?	1	2	3	4	5
(12)	3.0	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you:

		No	Yes	Don't remember
(13)	a. study this same topic in another course?	1 48%	2 44%	3 8%
	b. perform another lab on this same topic?	1 72%	2 16%	3 12%
(15)	c. perform this lab before?	1 68%	2 28%	3 4%

7. In minutes, approximately how much time did you spend:

(16-18) a. in the room setting up and preparing to conduct the experiment? $\bar{x}$ = 42 (range 0-120
(19-21) b. in this lab session working on the experiment? $\bar{x}$ = 129 (range 0-240)
(22-24) c. outside of lab writing up the report? $\bar{x}$ = 158 (range 60-300)

(25) 8. The amount of time alloted for this lab session was:

8% (1) too much (more than necessary)
4% (2) too little (How much more time was needed? ______)
88% (3) about right

(26) 9. For this lab session, did you work:

100% (1) alone
____ (2) with one other person
____ (3) with two other people
____ (4) with more than two people (How many? ______)

10. Compared to other lab sessions in this course, how would you rate your:

	$\bar{x}$		Lower		Same		Higher	Don't know
(27)	3.4	a. level of attention in this lab session?	1	2	3	4	5	( )
(28)	3.1	b. interest in the content of this lab session?	1	2	3	4	5	( )

11. What 2 or 3 things did you learn from this lab session?

12. How effective was the lab session in helping you:

	$\bar{x}$		Not at all effective				Very effective	Don't know/ Doesn't apply
(29)	2.9	a. understand calculations?	1	2	3	4	5	( )
	3.1	b. understand results?	1	2	3	4	5	( )
(31)	3.0	c. understand basic principles involved?	1	2	3	4	5	( )

13. How confident did you feel:

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
(32)	3.3	a. using the equipment?	1	2	3	4	5	( )
	3.3	b. following instructions?	1	2	3	4	5	( )
	3.2	c. conducting the experiment?	1	2	3	4	5	( )
(35)	2.8	d. reporting results of your experiment?	1	2	3	4	5	( )

(36) 14. During the lab session, did anything occur that interferred with your carrying out the experiment?

74% (1) no
26% (2) yes. Please describe.

15. What did you like most about this lab session?

16. What suggestions do you have for improving this lab session?

17. Please indicate the extent to which you agree or disagree with each of the follwoing statements:

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know
(37)	3.1	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.1	b.	In view of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.2	c.	I was bored most of the time in this lab session.	1	2	3	4	5	( )
	2.9	d.	I was confused most of the time in this lab session.	1	2	3	4	5	( )
	2.6	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.7	f.	I feel that manipulation of apparatus increased my understanding of lab concepts.	1	2	3	4	5	( )
	2.4	g.	I had difficulty trying to figure out how to set up the equipment.	1	2	3	4	5	( )
(44)	2.5	h.	I think simulations or videotapes of experiments would be just as effective in learning the material.	1	2	3	4	5	( )

(45) 18. Did you view a videodisc on the topic of this lab?
61%(1) no
39%(2) yes
____(3) don't remember

Thank you for your comments.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ____ Course: Wisconsin Unknowns Summer '83 (N ≃ 5 students)

Date: ____

(3) Title of videodisc (check one):

____ (1) Chemistry: Titration
✓ (2) Chemistry: Unknowns
____ (3) Biology: Respiration
____ (4) Biology: Climate and Life
____ (5) Physics: Physics of Motion
____ (6) Physics: Physics of Rotational Motior

(4) 1. What is the general area of your major?

____ (1) undeclared
____ (2) engineering
50% (3) physical sciences
____ (4) biological sciences
____ (5) social sciences
____ (6) humanities
50% (7) other (describe): ____

(5) 2. What is your approximate grade point average (GPA) at this school?

40% (1) 3.5-4.0
20% (2) 3.0-3.4
20% (3) 2.5-2.9
____ (4) 2.0-2.4
____ (5) 1.5-1.9
____ (6) below 1.5
20% (7) no GPA yet

(6) 3. What is your gender?

80% (1) male
20% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) - (2) no (what is your first language? ____)

5. Prior to this videodisc how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	1.2	a. using microcomputers?	1	2	3	4	5
	1.2	b. using videodisc players?	1	2	3	4	5
(11)	2.8	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 40%	2 60%	3
	b. perform or view another lab experiment on this same topic?	1 40%	2 60%	3
(14)	c. perform this lab before?	1 40%	2 60%	3

(15) 7. How many separate sessions did you view this videodisc?

60% (1) one
40% (2) two
____ (3) three or more (How many? ____)

8. In minutes, approximately how much time did you spend

(16-18) a. in preparation before you actually began working on the videodisc lab? 2
(19-21) b. actually working on the videodisc? 25 (range 15-40 min)
(22-24) c. outside of lab writing up a report? —

(25) 9. The amount of time you were allowed for viewing this disc was

20% (1) too much (more than necessary)
20% (2) too little (How much more time was needed? ______________)
60% (3) about right

(26) 10. For this lab videodisc, did you work

100% (1) alone,
____ (2) with one other person
____ (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

____ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	2.5	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.0	b. because another student recommended it	1	2	3	4	5
	2.0	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	3.0	d. to learn more about the subject matter	1	2	3	4	5
	1.5	e. to do better on the exams or tests	1	2	3	4	5
	1.0	f. in order to obtain extra credit	1	2	3	4	5
	3.0	g. as a substitute for another assignment or test	1	2	3	4	5
(30)	2.5	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

$\bar{x}$		Lower		Same		Higher	Don't Know
3.8	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
3.8	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

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15. How effective was the videodisc in helping you

	$\bar{x}$			Not at all effective				Very effective	Don't know
38)	1.8	a.	understand calculations?	1	2	3	4	5	( )
	2.5	b.	understand results?	1	2	3	4	5	( )
40)	2.8	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$			Not at all confident				Very confident	Don't know/ Doesn't apply
41)	3.8	a.	using the hardware	1	2	3	4	5	( )
	3.8	b.	conducting the experiment	1	2	3	4	5	( )
	3.8	c.	reporting results of your experiment	1	2	3	4	5	( )
44)	4.0	d.	following instructions	1	2	3	4	5	( )

45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

60% (1) no
40% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	4.0	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.8	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.6	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	1.2	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.5	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.4	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( ) ( )
	1.6	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( ) ( )
	2.3	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( ) ( )
54)	3.6	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

20. (Con.)

				Strongly disagree				Strongly agree	Don kno Doesn app
(55)	2 2	j.	I would like more labs on videodisc.	1	2	3	4	5	(
	3.0	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	2.5	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.8	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

				No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.3	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.2	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.2	c.	using the keyboard?	1	2	3	4	5	( )
(62)	1.3	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

				Not at all effective				Very effective	Don' know
(63)	3.8	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.9	b.	instructions on the videodisc	1	2	3	4	5	( )
	3.9	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3.0	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.2	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.2	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.4	g.	explanations	1	2	3	4	5	( )
	3.4	h.	quizzes	1	2	3	4	5	( )
	3.8	i.	visual images and action (content)	1	2	3	4	5	( )
	3.8	j.	quality of the sound	1	2	3	4	5	( )
	4.2	k.	quality of the video screen picture	1	2	3	4	5	( )
	4.2	l.	readibility of the text on the screen	1	2	3	4	5	( )
	4.0	m.	overall production quality	1	2	3	4	5	( )
(76)	1.0	n.	student worksheets (N=1)	1	2	3	4	5	( )

23. How would you rate the

(77)	3.4	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.2	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	3.0	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

60% (1) 0
40% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: Nebraska Course: Chemistry Unknowns (N ≃ 6)

Date: ____

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
___ (5) Physics: Physics of Motion
✓ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

17% (1) undeclared
___ (2) engineering
17% (3) physical sciences
33% (4) biological sciences
___ (5) social sciences
___ (6) humanities
33% (7) other (describe): ____

(5) 2. What is your approximate grade point average (GPA) at this school?

50% (1) 3.5-4.0
___ (2) 3.0-3.4
50% (3) 2.5-2.9
___ (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
___ (7) no GPA yet

(6) 3. What is your gender?

50% (1) male
50% (2) female

(7) 4. Is English your first language?

67% (1) yes
(8) 33% (2) no (what is your first language? ____)

5. Prior to this videodis how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.7	a. using microcomputers?	1	2	3	4	5
	1.7	b. using videodisc players?	1	2	3	4	5
(11)	3.7	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 83%	2 17%	3
	b. perform or view another lab experiment on this same topic?	1 83%	2 17%	3
(14)	c. perform this lab before?	1 83%	2 17%	3

(15) 7. How many separate sessions did you view this videodisc?

40% (1) one
___ (2) two
60% (3) three or more (How many? ____)

8. In minutes, approximately how much time did you spend (0-36)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}=12$

(19-21) b. actually working on the videodisc? $x = 82$ (30-150)

(22-24) c. outside of lab writing up a report? $\bar{x} = 7$ (0-24)

(25) 9. The amount of time you were allowed for viewing this disc was

___ (1) too much (more than necessary)
17% (2) too little (How much more time was needed? ________________)
83% (3) about right

(26) 10. For this lab videodisc, did you work

50% (1) alone
50% (2) with one other person
___ (3) with two other people
___ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

17% (1) yes
83% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	4.0	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.5	b. because another student recommended it	1	2	3	4	5
	4.3	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	4.3	d. to learn more about the subject matter	1	2	3	4	5
	4.8	e. to do better on the exams or tests	1	2	3	4	5
	1.5	f. in order to obtain extra credit	1	2	3	4	5
	1.5	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	2.0	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.7	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	4.2	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.2	a. understand calculations?	1	2	3	4	5	( )
	2.5	b. understand results?	1	2	3	4	5	( )
(40)	3.3	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't app
(41)	3.2	a. using the hardware	1	2	3	4	5	( )
	3.2	b. conducting the experiment	1	2	3	4	5	( )
	3.2	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	4.0	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

83% (1) no
17% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	2 0	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.3	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	1.7	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	1.5	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.9	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.0	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.7	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.3	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	3.2	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

			20. (Con.)	Strongly disagree				Strongly agree	Don kno Doesn app
(55)	3.8	j.	I would like more labs on videodisc.	1	2	3	4	5	(
	2.2	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	(
	3.2	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	(
(58)	1.8	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	(

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know. Doesn apply
(59)	1.0	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	2.0	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.0	c.	using the keyboard?	1	2	3	4	5	( )
(62)	1.3	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don' know
(63)	3.2	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.5	b.	instructions on the videodisc	1	2	3	4	5	( )
	3.8	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3.8	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	2.6	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.5	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.8	g.	explanations	1	2	3	4	5	( )
	2.6	h.	quizzes	1	2	3	4	5	( )
	3.5	i.	visual images and action (content)	1	2	3	4	5	( )
	2.7	j.	quality of the sound	1	2	3	4	5	( )
	3.0	k.	quality of the video screen picture	1	2	3	4	5	( )
	3.7	l.	readibility of the text on the screen	1	2	3	4	5	( )
	2.7	m.	overall production quality	1	2	3	4	5	( )
(76)	4.0	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	3.3	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	3.3	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	3.2	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

67% (1) 0
(2) 1
33% (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: UCLA Course: Chemistry Unknowns (N ≃ 10)

Date: ____

(3) Title of videodisc (check one):

- ___ (1) Chemistry: Titration
- ✓ (2) Chemistry: Unknowns
- ___ (3) Biology: Respiration
- ___ (4) Biology: Climate and Life
- ___ (5) Physics: Physics of Motion
- ___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

- ___ (1) undeclared
- ___ (2) engineering
- 20% (3) physical sciences
- 70% (4) biological sciences
- 10% (5) social sciences
- ___ (6) humanities
- ___ (7) other (describe): ____

(5) 2. What is your approximate grade point average (GPA) at this school?

- 20% (1) 3.5-4.0
- 50% (2) 3.0-3.4
- 20% (3) 2.5-2.9
- ___ (4) 2.0-2.4
- ___ (5) 1.5-1.9
- ___ (6) below 1.5
- 10% (7) no GPA yet

(6) 3. What is your gender?

- 50% (1) male
- 50% (2) female

(7) 4. Is English your first language?

- 80% (1) yes
- (8) 20% (2) no (what is your first language? ____)

5. Prior to this videodisc how would you rate your skills i

	$\bar{x}$		Not at all skilled				Very skilled
(9)	1.8	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
(11)	3.0	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 50%	2 50%	3
	b. perform or view another lab experiment on this same topic?	1 40%	2 60%	3
(14)	c. perform this lab before?	1 50%	2 50%	3

(15) 7. How may separate sessions did you view this videodisc?

- 100% (1) one
- ___ (2) two
- ___ (3) three or more (How many? ____)

8. In minutes, approximately how much time did you spend

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x}$ = 2 (0-5)
(19-21) b. actually working on the videodisc? $\bar{x}$ = 27 (0-45)
(22-24) c. outside of lab writing up a report? 0

(25) 9. The amount of time you were allowed for viewing this disc was

____ (1) too much (more than necessary)
22% (2) too little (How much more time was needed? ________________)
78% (3) about right

(26) 10. For this lab videodisc, did you work

80% (1) alone
20% (2) with one other person
____ (3) with two other people
____ (4) with more than two people

(27) 11. Was it required that you view this videodisc?

____ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	2.3	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.6	b. because another student recommended it	1	2	3	4	5
	2.3	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	2.5	d. to learn more about the subject matter	1	2	3	4	5
	3.2	e. to do better on the exams or tests	1	2	3	4	5
	1.5	f. in order to obtain extra credit	1	2	3	4	5
	1.5	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	3.9	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	4.3	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.6	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$			Not at all effective				Very effective	Don't know
(38)	1.6	a.	understand calculations?	1	2	3	4	5	( )
	2.8	b.	understand results?	1	2	3	4	5	( )
(40)	2.7	c.	understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$			Not at all confident				Very confident	Don't know/ Doesn't appl
(41)	3.7	a.	using the hardware	1	2	3	4	5	( )
	3.2	b.	conducting the experiment	1	2	3	4	5	( )
	2.7	c.	reporting results of your experiment	1	2	3	4	5	( )
(44)	3.9	d.	following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

80% (1) no
20% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	2.1	a.	I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.2	b.	In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.1	c.	I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	d.	I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.2	e.	My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.6	f.	I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.4	g.	I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.6	h.	I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	4.4	i.	I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

	20. (Con.) $\bar{x}$		Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	2.8 j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	3.3 k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.9 l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.6 m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.0 a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.1 b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.0 c.	using the keyboard?	1	2	3	4	5	( )
(62)	1.1 d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective				Very effective	Don' know
(63)	3.9 a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	4.0 b.	instructions on the videodisc	1	2	3	4	5	( )
	4.2 c.	opportunities to work at own pace	1	2	3	4	5	( )
	2.4 d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3.7 e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	2.3 f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.8 g.	explanations	1	2	3	4	5	( )
	2.6 h.	quizzes	1	2	3	4	5	( )
	3.3 i.	visual images and action (content)	1	2	3	4	5	( )
	2.6 j.	quality of the sound	1	2	3	4	5	( )
	2.6 k.	quality of the video screen picture	1	2	3	4	5	( )
	3.0 l.	readibility of the text on the screen	1	2	3	4	5	( )
	3.3 m.	overall production quality	1	2	3	4	5	( )
(76)	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	3.6 a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.6 b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9 c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: Illinois Central College Course: Physics

Date: ____________ Physics of Motion (N ≃ 30)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
✓ (5) Physics: Physics of Motion
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

7% (1) undeclared
37% (2) engineering
7% (3) physical sciences
23% (4) biological sciences
___ (5) social sciences
___ (6) humanities
26% (7) other (describe): ____________

(5) 2. What is your approximate grade point average (GPA) at this school?

10% (1) 3.5-4.0
21% (2) 3.0-3.4
45% (3) 2.5-2.9
17% (4) 2.0-2.4
3% (5) 1.5-1.9
___ (6) below 1.5
3% (7) no GPA yet

(6) 3. What is your gender?

83% (1) male
17% (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ____________)

5. Prior to this videodisc how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.0	a. using microcomputers?	1	2	3	4	5
	1.9	b. using videodisc players?	1	2	3	4	5
(11)	2.7	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 33%	2 67%	3
	b. perform or view another lab experiment on this same topic?	1 50%	2 50%	3
(14)	c. perform this lab before?	1 93%	2 7%	3

(15) 7. How may separate sessions did you view this videodisc?

43% (1) one
37% (2) two
20% (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend (0-280)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{X} = 26$
(19-21) b. actually working on the videodisc? $\bar{X} = 162$ (15-300)
(22-24) c. outside of lab writing up a report? $\bar{X} = 57$ (10-180)

(25) 9. The amount of time you were allowed for viewing this disc was

3% (1) too much (more than necessary)
35% (2) too little (How much more time was needed? ________)
62% (3) about right

(26) 10. For this lab videodisc, did you work

18% (1) alone
32% (2) with one other person
14% (3) with two other people
36% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

100% (1) yes
____ (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

			Not an important reason				A very important reason
(28)	a.	because the professor or teaching assistant recommended it	1	2	3	4	5
	b.	because another student recommended it	1	2	3	4	5
	c.	to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d.	to learn more about the subject matter	1	2	3	4	5
	e.	to do better on the exams or tests	1	2	3	4	5
	f.	in order to obtain extra credit	1	2	3	4	5
	g.	as a substitute for another assignment or test	1	2	3	4	5
(35)	h.	to see what videodiscs are all about	1	2	3	4	5
	i.	other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{X}$			Lower		Same		Higher	Don't Know
(36)	3.5	a.	level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.2	b.	interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.4	a. understand calculations?	1	2	3	4	5	( )
	2.7	b. understand results?	1	2	3	4	5	( )
(40)	2.1	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
(41)	3.3	a. using the hardware	1	2	3	4	5	( )
	3.4	b. conducting the experiment	1	2	3	4	5	( )
	3.1	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	3.7	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

34% (1) no
66% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.1	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.0	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.4	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.3	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.3	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.8	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.2	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.8	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	2.7	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

			20. (Con.)	Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	3.4	j.	I would like more labs on videodisc.	1	2	3	4	5	( )
	2,8	k.	If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3,2	l.	I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.2	m.	This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$			No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1.1	a.	inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	2.0	b.	operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.3	c.	using the keyboard?	1	2	3	4	5	( )
(62)	2.9	d.	with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$			Not at all effective				Very effective	Don't know
(63)	3.9	a.	printed instructions on "how to begin"	1	2	3	4	5	( )
	3.9	b.	instructions on the videodisc	1	2	3	4	5	( )
	4.1	c.	opportunities to work at own pace	1	2	3	4	5	( )
	3,5	d.	opportunities for feedback on answers	1	2	3	4	5	( )
	3,0	e.	opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	2,4	f.	opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.5	g.	explanations	1	2	3	4	5	( )
	3.3	h.	quizzes	1	2	3	4	5	( )
	4.0	i.	visual images and action (content)	1	2	3	4	5	( )
	4.0	j.	quality of the sound	1	2	3	4	5	( )
	4.0	k.	quality of the video screen picture	1	2	3	4	5	( )
	4.1	l.	readibility of the text on the screen	1	2	3	4	5	( )
	4.0	m.	overall production quality	1	2	3	4	5	( )
(76)	2.0	n.	student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$									
(77)	2.9	a.	challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.7	b.	amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9	c.	level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: Kansas State Course: Physics

Date: ____________ Physics of Motion (N ≃ 9)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (3) Biology: Respiration
✓ (5) Physics: Physics of Motion
___ (2) Chemistry: Unknowns
___ (4) Biology: Climate and Life
___ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

___ (1) undeclared
78% (2) engineering
22% (3) physical sciences
___ (4) biological sciences
___ (5) social sciences
___ (6) humanities
___ (7) other (describe): ____________

(5) 2. What is your approximate grade point average (GPA) at this school?

___ (1) 3.5-4.0
33% (2) 3.0-3.4
33% (3) 2.5-2.9
22% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
11% (7) no GPA yet

(6) 3. What is your gender?

100% (1) male
___ (2) female

(7) 4. Is English your first language?

100% (1) yes
(8) ___ (2) no (what is your first language? ____________)

5. Prior to this videodis how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
(9)	2.6	a. using microcomputers?	1	2	3	4	5
	1.7	b. using videodisc players?	1	2	3	4	5
(11)	2.4	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 11%	2 89%	3
	b. perform or view another lab experiment on this same topic?	1 33%	2 77%	3
(14)	c. perform this lab before?	1 100%	2	3

(15) 7. How many separate sessions did you view this videodisc?

50% (1) one
50% (2) two
___ (3) three or more (How many? ______)

8. In minutes, approximately how much time did you spend

(0-20)

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 5$
(19-21) b. actually working on the videodisc? $\bar{x} = 133$ (10 - 380)
(22-24) c. outside of lab writing up a report? $\bar{x} = 87$ (30 - 180)

(25) 9. The amount of time you were allowed for viewing this disc was

11% (1) too much (more than necessary)
____ (2) too little (How much more time was needed? ________________)
89% (3) about right

(26) 10. For this lab videodisc, did you work

22% (1) alone
11% (2) with one other person
56% (3) with two other people
11% (4) with more than two people

(27) 11. Was it required that you view this videodisc?

____ (1) yes
100% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

	$\bar{x}$		Not an important reason				A very important reason
(28)	1.7	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.4	b. because another student recommended it	1	2	3	4	5
	1.1	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	2.6	d. to learn more about the subject matter	1	2	3	4	5
	1.6	e. to do better on the exams or tests	1	2	3	4	5
	1.4	f. in order to obtain extra credit	1	2	3	4	5
	4.7	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	4.3	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	3.3	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	3.4	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.4	a. understand calculations?	1	2	3	4	5	( )
	3.5	b. understand results?	1	2	3	4	5	( )
(40)	4.2	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't appl.
(41)	3.3	a. using the hardware	1	2	3	4	5	( )
	3.8	b. conducting the experiment	1	2	3	4	5	( )
	3.8	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	3.3	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

33% (1) no
67% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	3.8	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.5	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.0	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.5	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	3.0	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.4	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.9	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.9	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
(54)	2.5	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

	$\bar{x}$	20. (Con.)	Strongly disagree				Strongly agree	Don' know Doesn' appl
(55)	3.8	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.4	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3,7	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.0	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

	$\bar{x}$	21. Did you have any problems	No, not at all				Yes, very much so	Don't know/ Doesn' apply
(59)	1,0	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.0	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.3	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.9	d. with the reliability of the equipment?	1	2	3	4	5	( )

	$\bar{x}$	22. Please rate the effectiveness of the following features	Not at all effective				Very effective	Don' know
(63)	4,1	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.5	b. instructions on the videodisc	1	2	3	4	5	( )
	4.1	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.7	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3,6	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	1.7	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.4	g. explanations	1	2	3	4	5	( )
	3.1	h. quizzes	1	2	3	4	5	( )
	3,9	i. visual images and action (content)	1	2	3	4	5	( )
	4.0	j. quality of the sound	1	2	3	4	5	( )
	3.9	k. quality of the video screen picture	1	2	3	4	5	( )
	3.8	l. readibility of the text on the screen	1	2	3	4	5	( )
	3.0	m. overall production quality	1	2	3	4	5	( )
(76)	1.0	n. student worksheets	1	2	3	4	5	( )

	$\bar{x}$	23. How would you rate the							
(77)	2.6	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.2	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.6	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

100% (1) 0
____ (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

(1-2) Campus: ______________ Course: Illinois Central

Date: ______________ Physics

Energy Transformation

(N ≃ 61).

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
✓ (6) Physics: Physics of Rotational Motion

(4) 1. What is the general area of your major?

- (1) undeclared
70 % (2) engineering
7 % (3) physical sciences
13 % (4) biological sciences
2 % (5) social sciences
- (6) humanities
8 % (7) other (describe): ______________

(5) 2. What is your approximate grade point average (GPA) at this school? (N=35)

34 % (1) 3.5-4.0
46 % (2) 3.0-3.4
17 % (3) 2.5-2.9
3 % (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
___ (7) no GPA yet

(6) 3. What is your gender? (N=35)

86 % (1) male
14 % (2) female

(7) 4. Is English your first language? (N=35)

94 % (1) yes
(8) 6 % (2) no (what is your first language? ______________)

5. Prior to this videodisc how would you rate your skills in

		Not at all skilled				Very skilled	$\bar{x}$
(9)	a. using microcomputers?	1	2	3	4	5	3.1
	b. using videodisc players?	1	2	3	4	5	1.9
(11)	c. typing?	1	2	3	4	5	2.9

6. Prior to this lab session, did you

		No	Yes	Don't Remember
(12)	a. study this same topic in another course?	1 25%	2 73%	3 2%
	b. perform or view another lab experiment on this same topic?	1 50%	2 47%	3 3%
(14)	c. perform this lab before?	1 98%	2 2%	3 -

(15) 7. How many separate sessions did you view this videodisc? (N=35)

86 % (1) one
3 % (2) two
11 % (3) three or more (How many?

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8. In minutes, approximately how much time did you spend

(16-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 8.9$
(19-21) b. actually working on the videodisc? $\bar{x} = 100.2$
(22-24) c. outside of lab writing up a report? $\bar{x} = 21.4$

(25) 9. The amount of time you were allowed for viewing this disc was

12% (1) too much (more than necessary)
46% (2) too little (How much more time was needed? ________________)
42% (3) about right

(26) 10. For this lab videodisc, did you work

- (1) alone
- (2) with one other person
- (3) with two other people
100% (4) with more than two people

(27) 11. Was it required that you view this videodisc? (N=35)

97% (1) yes
3% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc):

		Not an important reason				A very important reason
(28)	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	b. because another student recommended it	1	2	3	4	5
	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	d. to learn more about the subject matter	1	2	3	4	5
	e. to do better on the exams or tests	1	2	3	4	5
	f. in order to obtain extra credit	1	2	3	4	5
	g. as a substitute for another assignment or test	1	2	3	4	5
(35)	h. to see what videodiscs are all about	1	2	3	4	5
	i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
(36)	2.5	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
(37)	2.8	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you [illegible] (N = 30)

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	2.2	a. understand calculations?	1	2	3	4	5	( )
	2.8	b. understand results?	1	2	3	4	5	( )
(40)	3.1	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel (N = 43)

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
(41)	2.7	a. using the hardware	1	2	3	4	5	( )
	2.9	b. conducting the experiment	1	2	3	4	5	( )
	2.9	c. reporting results of your experiment	1	2	3	4	5	( )
(44)	2.9	d. following instructions	1	2	3	4	5	( )

(45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

61% (1) no
39% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
(46)	27	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	2.8	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	30	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.2	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	3.5	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	2.3	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	2.4	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
54)	3.4	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

			Strongly disagree				Strongly agree	Don't know/ Doesn't apply
20. (Con.)								
(55)	2.6	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	3.4	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	2.9	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.3	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems (N=25)

	$\bar{x}$		No, not at all				Yes, very much so	Don't know/ Doesn't apply
(59)	1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	2.1	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.1	c. using the keyboard?	1	2	3	4	5	( )
(62)	3.3	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features [illegible]

	$\bar{x}$		Not at all effective				Very effective	Don't know
(63)	3.5	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.4	b. instructions on the videodisc	1	2	3	4	5	( )
	3.9	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.0	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.4	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.6	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	2.7	g. explanations	1	2	3	4	5	( )
	2.8	h. quizzes	1	2	3	4	5	( )
	4.3	i. visual images and action (content)	1	2	3	4	5	( )
	4.1	j. quality of the sound	1	2	3	4	5	( )
	4.2	k. quality of the video screen picture	1	2	3	4	5	( )
	4.0	l. readibility of the text on the screen	1	2	3	4	5	( )
	3.7	m. overall production quality	1	2	3	4	5	( )
(76)	2.9	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	2.9	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.4	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9	c. level of information:	too elementary	1	2	3	4	5	too advanced

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(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course? (N=33)

67% (1) 0
24% (2) 1
9% (3) don't remember

25. Please make other comments about this videodisc, if you wish.

STUDENT REACTION TO VIDEODISC

Your responses will help us improve the videodisc. All comments will be kept confidential and will not affect your grade in this course. Please respond candidly.

1-2) Campus: ______________ Course: Energy

Date: ______________

Nebraska (N ≃ 100)

(3) Title of videodisc (check one):

___ (1) Chemistry: Titration
___ (2) Chemistry: Unknowns
___ (3) Biology: Respiration
___ (4) Biology: Climate and Life
___ (5) Physics: Physics of Motion
✓ (6) Physics: ~~Physics of Rotational Motion~~ Energy Tensformation

(4) 1. What is the general area of your major?

2% (1) undeclared
92% (2) engineering
5% (3) physical sciences
___ (4) biological sciences
___ (5) social sciences
___ (6) humanities
1% (7) other (describe): ______________

(5) 2. What is your approximate grade point average (GPA) at this school?

29% (1) 3.5-4.0
39% (2) 3.0-3.4
26% (3) 2.5-2.9
4% (4) 2.0-2.4
___ (5) 1.5-1.9
___ (6) below 1.5
1% (7) no GPA yet

(6) 3. What is your gender?

90% (1) male
10% (2) female

7) 4. Is English your first language?

89% (1) yes
8) 11% (2) no (what is your first language? ______________)

5. Prior to this videodisc how would you rate your skills in

	$\bar{x}$		Not at all skilled				Very skilled
9)	3.1	a. using microcomputers?	1	2	3	4	5
	2.2	b. using videodisc players?	1	2	3	4	5
11)	3.1	c. typing?	1	2	3	4	5

6. Prior to this lab session, did you

		No	Yes	Don't Remember
12)	a. study this same topic in another course?	1 17%	2 81%	3 2%
	b. perform or view another lab experiment on this same topic?	1 88%	2 7%	3 5%
14)	c. perform this lab before?	1 97%	2 2%	3 1%

15) 7. How may separate sessions did you view this videodisc?

34% (1) one
57% (2) two
9% (3) three or more (How many? ____)

8. In minutes, approximately how much time did you spend

6-18) a. in preparation before you actually began working on the videodisc lab? $\bar{x} = 17$
9-21) b. actually working on the videodisc? $\bar{x} = 200$
22-24) c. outside of lab writing up a report? $\bar{x} = 131$

5) 9. The amount of time you were allowed for viewing this disc was

1% (1) too much (more than necessary)
56% (2) too little (How much more time was needed? ________________)
43% (3) about right

6) 10. For this lab videodisc, did you work

– (1) alone
36% (2) with one other person
52% (3) with two other people
12% (4) with more than two people

7) 11. Was it required that you view this videodisc?

22% (1) yes
78% (2) no

12. If you were not required to view this videodisc, please indicate the reasons that you chose to do so (please leave this question blank if you were required to view the disc): $(N \simeq 75)$

	$\bar{x}$		Not an important reason				A very important reason
8)	2.7	a. because the professor or teaching assistant recommended it	1	2	3	4	5
	1.5	b. because another student recommended it	1	2	3	4	5
	1.6	c. to get additional help in an area in which I am having difficulties	1	2	3	4	5
	1.8	d. to learn more about the subject matter	1	2	3	4	5
	1.9	e. to do better on the exams or tests	1	2	3	4	5
	5,0	f. in order to obtain extra credit	1	2	3	4	5
	1.6	g. as a substitute for another assignment or test	1	2	3	4	5
35)	2.1	h. to see what videodiscs are all about	1	2	3	4	5
		i. other (please describe)					

13. Compared to other sessions in this course, how would you rate your

	$\bar{x}$		Lower		Same		Higher	Don't Know
36)	3.7	a. level of attention in this videodisc lab?	1	2	3	4	5	( )
37)	3.6	b. interest in the content of this videodisc lab?	1	2	3	4	5	( )

14. What 2 or 3 things did you learn from this videodisc?

15. How effective was the videodisc in helping you

	$\bar{x}$		Not at all effective				Very effective	Don't know
(38)	3.0	a. understand calculations?	1	2	3	4	5	( )
	3.3	b. understand results?	1	2	3	4	5	( )
40)	3.8	c. understand basic principles involved?	1	2	3	4	5	( )

16. How confident did you feel

	$\bar{x}$		Not at all confident				Very confident	Don't know/ Doesn't apply
41)	3.8	a. using the hardware	1	2	3	4	5	( )
	3.7	b. conducting the experiment	1	2	3	4	5	( )
	3.5	c. reporting results of your experiment	1	2	3	4	5	( )
44)		d. following instructions	1	2	3	4	5	( )

45) 17. During the time you spent viewing the videodisc, did anything occur that interferred with your carrying out the experiment?

54% (1) no

46% (2) yes. Please describe.

18. What did you like most about this lab?

19. What suggestions do you have for improving this lab session?

20. Please indicate the extent to which you agree or disagree with each of the following statements

	$\bar{x}$		Strongly disagree				Strongly agree	Don't know/ Doesn't apply
46)	3.1	a. I knew what I was expected to learn from this lab session.	1	2	3	4	5	( )
	3.4	b. In light of the effort I put into it, I was satisfied with what I learned in this lab session.	1	2	3	4	5	( )
	2.2	c. I was bored most of the time using the videodisc.	1	2	3	4	5	( )
	2.5	d. I was confused most of the time using the videodisc.	1	2	3	4	5	( )
	2.7	e. My interest in science has increased because of this lab session.	1	2	3	4	5	( )
	2.2	f. I would rather learn this material in a regular lab session than with a videodisc.	1	2	3	4	5	( )
	1.9	g. I found it difficult to concentrate on the course material because of the hardware.	1	2	3	4	5	( )
	3.0	h. I felt as if I had a private tutor while using the interactive videodisc.	1	2	3	4	5	( )
54)	2.5	i. I could learn more through a "real" experiment rather than through videodiscs.	1	2	3	4	5	( )

		20. (Con.)	Strongly disagree 1	2	3	4	Strongly agree 5	Don't know/ Doesn't apply
(55)	3.5	j. I would like more labs on videodisc.	1	2	3	4	5	( )
	2.1	k. If I were to use videodiscs again, I would prefer to work alone.	1	2	3	4	5	( )
	3.2	l. I wish I could get printed copies of the information that was on videodisc.	1	2	3	4	5	( )
(58)	2.0	m. This videodisc had too much text, too much to read.	1	2	3	4	5	( )

21. Did you have any problems

	$\bar{x}$		No, not at all 1	2	3	4	Yes, very much so 5	Don't know/ Doesn't apply
(59)	1.2	a. inserting the videodisc or computer diskette?	1	2	3	4	5	( )
	1.5	b. operating the videodisc and videodisc player?	1	2	3	4	5	( )
	1.3	c. using the keyboard?	1	2	3	4	5	( )
(62)	1.5	d. with the reliability of the equipment?	1	2	3	4	5	( )

22. Please rate the effectiveness of the following features

	$\bar{x}$		Not at all effective 1	2	3	4	Very effective 5	Don't know
(63)	3.7	a. printed instructions on "how to begin"	1	2	3	4	5	( )
	3.7	b. instructions on the videodisc	1	2	3	4	5	( )
	39	c. opportunities to work at own pace	1	2	3	4	5	( )
	3.5	d. opportunities for feedback on answers	1	2	3	4	5	( )
	3.5	e. opportunities to review easily any part of the lesson	1	2	3	4	5	( )
	3.2	f. opportunities to skip any part of the lesson	1	2	3	4	5	( )
	3.2	g. explanations	1	2	3	4	5	( )
	3.4	h. quizzes	1	2	3	4	5	( )
	4.0	i. visual images and action (content)	1	2	3	4	5	( )
	4.0	j. quality of the sound	1	2	3	4	5	( )
	4.4	k. quality of the video screen picture	1	2	3	4	5	( )
	4.3	l. readibility of the text on the screen	1	2	3	4	5	( )
	4.1	m. overall production quality	1	2	3	4	5	( )
(76)	3.4	n. student worksheets	1	2	3	4	5	( )

23. How would you rate the

	$\bar{x}$								
(77)	3.1	a. challenge of the lesson:	too easy	1	2	3	4	5	too hard
	2.7	b. amount of new information:	too little	1	2	3	4	5	too much
(79)	2.9	c. level of information:	too elementary	1	2	3	4	5	too advanced

(80) 24. Prior to this videodisc lesson, how many different videodisc lessons have you used in this course?

97% (1) 0
3% (2) 1
____ (3) don't remember

25. Please make other comments about this videodisc, if you wish.